The RUBBER RESEARCH INSTITUTE *of* CEYLON

ANNUAL REVIEW FOR 1961

MARCH 1962

RUBBER RESEARCH INSTITUTE OF CEYLON

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(as at 31st December 1961)

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Dr. E. D. C. Baptiste, Ph.D. (Lond.), M.Sc., A.R.C.S., D.I.C., F.I.R.I.

Smallholdings Department Selection Committee:

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Mr. W. P. H. Dias, J.P.
Dr. E. D. C. Baptiste, Ph.D. (Lond.), M.Sc., A.R.C.S., D.I.C., F.I.R.I.
Mr. A. B. Dissanayake, B.Sc. Ag. (Cey.).

THE
RUBBER RESEARCH INSTITUTE OF CEYLON

ANNUAL REVIEW 1961

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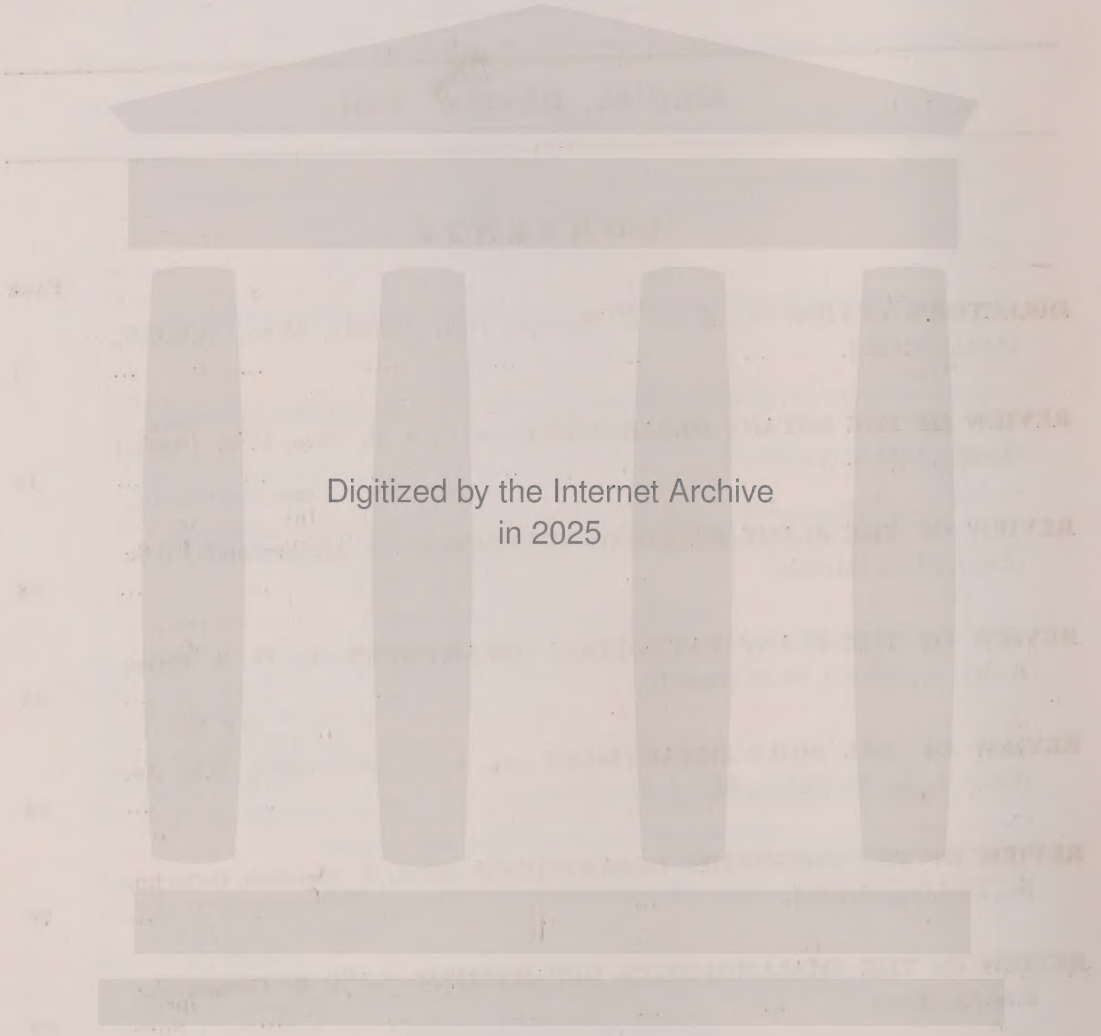

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THE
RUBBER RESEARCH INSTITUTE OF CEYLON
ANNUAL REVIEW FOR 1961

DIRECTOR'S REVIEW

By

E. D. C. Baptiste

1. GENERAL

Mr. T. C. A. de Soysa, B.A. (Cantab.) Dip. Agric. (Cantab.), a representative of the Low Country Products Association on the Rubber Research Board, was elected Chairman of the Board on 24 January in succession to Mr. S. Pathmanathan who had very ably occupied the Chair since 2 February 1955.

The Industry's recommendations for an increase in the rubber research cess from thirty three-fortieth of a cent to one cent on every pound of rubber exported received Government's assent on 19 June 1961 under the Rubber Research (Amendment) Act No. 58 of 1961.

This Act also gave retrospective validity under the Rubber Research Ordinance to past acts done and rules made in relation to the Senior and Intermediate Staff Medical Scheme and the Junior Staff Medical Fund already established by the Rubber Research Board.

The Provident Fund Rules of the Institute were revised to satisfy the requirements of the Labour Commissioner under the Provident Fund Act. No. 15 of 1958. The revised rules await Ministerial approval.

In order to comply with the Government Language Policy, the Rubber Research Board authorised the appointment of a Sinhala Translator and to provide instructions in Sinhala to Institute's officers.

The London Advisory Committee for Rubber Research which had served the Ceylon rubber industry for forty years, was dissolved at the end of 1960. Its functions have been taken over by the Co-ordinating Advisory Committee of the Malayan Rubber Fund Board, and those of the Agricultural Sub-Committee of the London Advisory Committee by a Panel of Consultants.

The Rubber Research Board has agreed to participate with the Board of the R.R.I. of Malaya in the services established in replacement of those formerly carried out by the London Advisory Committee and by its Agricultural Sub-Committee on the same basis as before, *pro rata* to the exports of rubber from each of the contributing territories, *i.e.* Ceylon 1/7, Malaya 6/7.

Mr. J. A. Nelson, who had been Secretary of the London Advisory Committee for Rubber Research (Ceylon & Malaya) since 1921, retired on 30 June 1961 and in recognition of his valuable services, was awarded a retirement gratuity by the Boards of the two Institutes.

The Director represented the Rubber Research Board at meetings of the International Rubber Research and Development Board held in London from 5 to 8 June 1961. He also attended the final meeting of the London Advisory Committee for Rubber Research and a meeting of the Executive Council of the Institution of the Rubber Industry, during his period of home leave.

The Chairman and the Director have, with the Board's approval, accepted an invitation to attend the International Conference on Rubber (Natural and Synthetic) to be held in Paris from 14 to 18 May 1962. Both the Chairman and the Director have been invited to preside over a session of the Conference and in addition, the Director has been selected to deliver a lecture on the present position and future possibilities of *Hevea* production.

The Rubber Research Board has also approved of the participation of the Director in the Symposium on Natural and Synthetic Rubber organised by the International Rubber Study Group which is to be held in Washington in May/June 1962.

The first experimental planting on the Kuruwita Sub-station situated in the Ratnapura District took place during the South-West monsoon planting season of 1961 when, of 80 acres cleared in the Autumn of 1960, 45 acres were planted with new clones bred by the Institute in small-scale trial with suitable controls, and 20 acres with clone PB 86 for manurial and cultivation experiments. The balance of 15 acres was planted up with experimental clones during the North-East monsoon planting season of 1961.

On this Sub-station work has been completed on the building of the Staff bungalow, the rubber factory and office and the smokehouse. Six double-unit labourers' cottages were nearing completion at the end of the year.

At Dartonfield new offices for the Works Section and an extension to the Estate Office have been completed. A two-storey frontage to the Administration Block and a Crepe Rubber Drying Tower were nearing completion at the end of the year.

The Rubber Research Board agreed that clones RRIC 7, 41, 45, 52 and 86 be declared "free" clones within Ceylon. In order to ensure that only authenticated budwood of these clones are sold by outside estates it was decided that the estates which have these clones in their multiplication nurseries be asked to get these nurseries registered by the Rubber Controller after inspection and identification of the clones by R.R.I.C. officers on payment of a fee.

A further exchange of IAN clones for breeding purposes was effected with the Firestone Plantations Company, Liberia.

The Rubber Research Board gave its approval for a request made by the Australian Government through the Ministry of Agriculture, Land, Irrigation and Power for the export of budwood of clones NAB 20 and RRIC 6 to Papua and New Guinea.

The Rubber Research Board decided to celebrate the Golden Jubilee of the Institute in early 1962.

Mr. W. B. Jonklaas, Superintendent of Illuktenne Estate, was appointed Visiting Agent of Dartonfield Group and of the RRIC Kuruwita Sub-station during the year.

2. STAFF

The Director, Dr. E. D. C. Baptiste, was on overseas leave from the beginning of the year until 20 March. He was again on duty in the United Kingdom from 3 to 15 June. During these periods Mr. C. A. de Silva, Botanist, acted for the Director.

The Botanist, Mr. C. A. de Silva, was on leave during the month of July prior to resuming duties for a further period of 2 years with effect from 1 August.

The Soils Chemist, Mr. A. J. Jeevaratnam, the Chief Advisory Officer Smallholdings, Mr. A. B. Dissanayake and the Chief Administrative Officer, Mr. C. D. de Fonseka, were on duty throughout the year.

The Rubber Chemist, Dr. K. F. Heinisch, was on overseas leave from the beginning of the year until 17 May and the Assistant Rubber Chemist, Mr. M. Nadarajah, acted for him during his absence.

The Plant Pathologist, Dr. A. Riggenbach, resigned his post on the termination of his contract and left the Island on 4 August. The Director was in nominal charge of the Plant Pathology Department until the resumption of duties on 27 December of Dr. O. S. Peries, the Assistant Plant Pathologist. Dr. Peries was appointed Acting Plant Pathologist as from that date.

The Agricultural Engineer, Mr. J. H. Lloyd, B.Sc. Hons. (Wales), who had been assigned to the Institute's service under the Colombo Plan for a period of two years to work exclusively on problems of *Phytophthora* control, assumed duties on 9 November.

The Plant Breeder, Mr. R. T. Wijewantha, continued his post-graduate studies in Plant Breeding and Plant Genetics at the University of California under the International Co-operation Administration of the United States of America.

The Estate Superintendent, Mr. L. Wijeyegunawardena, resumed duties on 16 January after his end-of-contract leave and was on duty during the rest of the period under review. The Assistant Superintendent, Mr. D. de S. de Fonseka, continued to act for the Superintendent until 15 January.

Mr. B. Cocking, Visiting Superintendent R.R.I.C. Kuruwita Sub-station, was on furlough from 1 February and Mr. R. K. Hermon acted for him until the end of July.

The Assistant Rubber Chemist, Mr. M. Nadarajah, the Assistant Botanist, Mr. L. B. Chandrasekera, and the Assistant Plant Breeder, Mr. D. M. Fernando, were on duty throughout the year.

The Senior Assistant Advisory Officer Smallholdings Department, Mr. H. H. Peiris, was on end-of-contract leave from 1 April until 30 June and the Assistant Advisory Officer (N), Mr. K. Wilson de Silva, was on end-of-contract leave from 1 June to 31 August.

The following Intermediate Staff Officers were on duty throughout the year:

Miss V. Sivapalan, Research Assistant, Plant Pathology Department.
Mr. R. Satchuthananthavale, Research Assistant, Botany Department.
Mrs. S. C. Goonetilleke, Librarian.
Mr. D. E. A. Abeywickrema, Assistant Advisory Officer Smallholdings Department.

The following Intermediate Staff appointments were made during the year:

1. Mr. S. W. Karunaratna, B.Sc. (Cey.), as Research Assistant, Rubber Chemistry Department with effect from 2 January.

2. Mr. P. A. Jayawardena, B.Sc. (Lond.), as Assistant Administrative Officer with effect from 2 January.

3. Mr. P. C. J. F. Keerthisingha as Works Inspector with effect from 16 January.

The following Intermediate Staff Officers left the service of the Institute during the year:

Mr. P. A. Jayawardena, Assistant Administrative Officer, with effect from 31 May.

Miss R. Abdul Cader, Research Assistant Soils Department, with effect from 15 September.

Mr. M. P. Wesenti-Pulle, Research Assistant Soils Department, with effect from 30 September.

Mr. D. de S. de Fonseka, Assistant Superintendent, with effect from 8 December.

3. MEETINGS

The Director and the Acting Director attended the following meetings:

Rubber Research Board	2	24/1, 27/2	Acting Director
	10	27/3, 12/5, 23/5, 29/5, 19/6, 4/7, 15/8, 31/10, 1/12, 12/12.	Director
Administrative Committee R.R.B.	1	16/1,	Acting Director
	4	18/4, 20/6, 1/9, 4/10	Director
Estate & Experimental Committee R.R.B.	1	13/2	Acting Director
	2	30/6, 10/10	Director
Selection Committee R.R.B.	5	8/9, 27/10, 10/11, 7/12, 21/12	Director
Smallholdings Selection Committee R.R.B.	1	5/1	Acting Director
Sub-Committee R.R.B.	3	16/5, 17/5, 19/5	Director
Rubber Replanting Advisory Board	5	9/1, 24/1, 7/2, 21/2, 13/6	Acting Director
	4	4/4, 7/8, 3/10, 5/12	Director
Planters' Association of Ceylon	2	14/2, 13/6	Acting Director
	5	24/3, 11/4, 15/8, 17/10, 12/12	Director

District Planters' Associations:			
Kalutara	3	28/7, 13/10, 6/12,	Director
Sabaragamuwa	1	28/2	Acting Director
Kelani Valley	1	16/3	" "
Low Country Products Association	1	25/3	Director
Ceylon Chamber of Commerce	1	29/3	Director
Ministry of Agriculture, Land, Irrigation & Power:			
Planning Committee	2	7/1, 16/2	Acting Director
	1	31/7	Director
Sub-Committee on Rehabilitation of Export Crops	1	24/10	Director
Rubber V.A. Conference	1	12/1	Acting Director
T.R.I. Biennial Conference	1	20/1	" "
Patents Advisory Committee	1	6/10	Director
Parliamentary Advisory Committee on Rubber	1	23/11	Director
C.I.S.I.R. Symposium	1	17/11	Director
Ceylon Association for the Advancement of Science	2	23/11, 24/11	Director
R.R.I.C. Staff Club	1	25/4	Director
International Rubber Research & Development Board meetings held in London	4	5/6, 6/6, 7/6, 8/6	Director

4. VISITS

Estates.—The Director paid 11 visits to estates during the year. He also paid 24 visits to R.R.I.C. stations and 4 visits to the R.R.I.C. Kuruwita Substation.

Institutes.—The Tea Research Institute of Ceylon and the Ceylon Institute for Scientific and Industrial Research were visited.

Smallholdings.—The Director, accompanied by the Chairman of the Rubber Research Board and the Botanist, attended the Annual Field Day of the Smallholdings Department of the Institute held at the Kesbewa Maha Vidyalaya, Kesbewa on 25 November.

Visits in U.K.—While in U.K. the Director visited the following research institutions:

The Department of Agriculture, University of Oxford.
The Horticultural Laboratories, University of Bristol.
The Long Ashton Agricultural and Horticultural Research Station.
The Botanical Laboratories, University of Exeter.
The John Innes Horticultural Institution, Hertford.
The Plant Physiology Laboratories, Royal College of Science, London.
The Laboratories of the Natural Rubber Producers' Research Association, Welwyn Garden City.

He also paid calls on the Secretary of the Natural Rubber Bureau, the Secretary of the International Rubber Research and Development Board and on officials of Shell International Chemical Co., Ltd.

5. VISITORS

There were 122 visitors during the year which included the following:—

Dr. D. L. Gunn, Director, Tea Research Institute of Ceylon.
Dr. F. R. Moorman, Soil Classification Specialist, F.A.O., Rome.
Mr. K. Y. Lee, Unimar Limited, Hong Kong.
Mr. S. Ananda Rau, Chief Scientific Officer, U.P.A.S.I., Coonoor, S. India.
Mr. I. N. R. Nair, Chief Scientific Officer, James Finlay & Co., Mannar, India.
Mr. P. W. Hudson, Fisons Pest Control Ltd., Cambridge, England.
Mr. C. Thirunadarajah, Soil Conservation Division, Department of Agriculture, Peradeniya.
Mr. P. Ganashan, Soil Conservation Division, Department of Agriculture, Peradeniya.
Dr. G. Heim, Ciba Ltd., Basle, Switzerland.
Mr. P. de Jong, Technical Manager, Tata-Fison Private Ltd., Bangalore, India.
Mr. R. Visio, Representative, Messrs. Wild Heerbrugg Ltd., Switzerland.
Mr. Ray Wijewardena, Landmaster Ltd., S. E. Asia Office, Colombo.
Mr. Henry Woods, Woods of Colchester, England.
Ir. P. I. Foursoff, N. V. Philips-Duphar, Amsterdam, Netherlands.
Dr. S. Narusawa, Head, Foundation for Natural Rubber Research and Development, Tokyo, Japan.
Mr. T. C. A. de Soysa, Chairman Rubber Research Board.
Dr. H. R. Ambler, Scientific Adviser, British High Commission, Delhi.
Mr. E. S. Hiscocks, Director, Tropical Products Institute, London.
Captain I. Mc Geoch, D.S.O., D.S.C., R.N., Imperial Defence College, London.
Air Commodore A. G. Powell, R.A.F., Imperial Defence College, London.
Mr. C. P. Fogg, Imperial Defence College, London.
Mr. G. Brownlee, British High Commission, Colombo.
Mr. G. Wrigley, Fisons Pest Control Ltd., Cambridge.
Baroness Agnete Engelhand, Sao Paulo, Brazil.
Mr. R. A. Smith, Buckingham, England.
Takashi Hanada, Leader of 3rd Japanese Youth Goodwill Mission and party of 17.
Captain Antonio Nunes Jimenez, Director, Cuban National Institute of Agrarian Reform, Habana, Cuba.
Ing. Julian B. Acuna Gale, Cuban Agr. Exp. Station, Habana.
Mr. Jesus Monzok, Cuban Agr. Exp. Station, Habana.
Dr. J. Le Bras, Institut Francais du Caoutchouc, Paris.
Mr. R. Martin, Agronomist I.R.C.A., Ivory Coast.
Prof. C. G. C. Chesters, Dept. of Botany, University of Nottingham.
Mr. A. B. Fagundes, Plant Production and Protection Division F.A.O., Rome.
Mr. Tennyson Rodrigo, Ministry of Industries, Colombo.
Dr. W. Guldnar, Battelle Research Institute, Frankfurt.
Dr. D. V. Ariyanayagam, Dept. of Agriculture, Peradeniya.

6. PUBLICATIONS

The following reports and articles were prepared by the Director:

(1) For information of the Rubber Research Board:
Director's Review for 1960.
Director's Report for the First Half-Year 1961.
Research Programmes for 1962.

(2) For information of the Rubber Replanting Advisory Board:
"Interplanting of Food Crops in Smallholders' Replantings".
"A Plea for declaring Clone RRIC 52 a Free Clone in Ceylon".

(3) Contribution to 1960 Annual Reports of the Planters' Association of Ceylon and of the Low Country Products Association:
"Progress Report of the Rubber Research Institute for 1960".

(4) Contribution to the 1960 Annual Report of the Kalutara District Planters' Association:
"Rubber" by Acting Director.

(5) Contribution to Ceylon Year Book 1961:
"Activities of the Rubber Research Institute of Ceylon in 1960" by Acting Director.

(6) For information of the Commissioner of Labour:
"Hevea Rubber Cultivation" by Acting Director.

(7) For information of the Minister of Agriculture, Land, Irrigation and Power:
"The Development of R.R.I.C. Clones" and "Research in Rubber Manufacture" by Acting Director.

(8) Contribution to the Times of Ceylon Agriculture and Industry Supplement, September 1961:

"The Prospects for Natural Rubber".

(9) For publication in R.R.I.C. Quarterly Journal:

(*a*) "*Phytophthora palmivora*" in Vol. 37, Part 1, March 1961.

(*b*) Answer to Question "When did *Oidium* leaf disease first appear in Ceylon and when was sulphur dusting first used to control it on estates and on smallholdings?" in Vol. 37, Part 2, June 1961.

(*c*) "Natural Rubber—Its Position and Prospects" in Vol. 37, Part 4, December 1961.

The following roneoed leaflets were issued:

(*a*) *Oidium* Questionnaire 1960/1961 dated 16-1-1961.

(*b*) *Phytophthora* Questionnaire 1961 dated 7-8-1961.

(*c*) "Tapping of Hevea Rubber"

(*d*) Advisory Leaflet PP/61/1—"*Phytophthora* Leaf and Bark Diseases. Warning 1961".

(*e*) Advisory Circular No. 70—"A Guide to the Cost of Replanting Rubber".

The following publications were issued:

(*a*) Annual Review of The Rubber Research Institute of Ceylon for 1960.

(*b*) 1st Quarterly Journal for 1961, Vol. 37, Part 1.
2nd Quarterly Journal for 1961, Vol. 37, Part 2.
3rd Quarterly Journal for 1961, Vol. 37, Part 3.
4th Quarterly Journal for 1961, Vol. 37, Part 4.

(*c*) Advisory Circular No. 71—Tapping of *Hevea* Rubber.

7. CORRESPONDENCE

		Inward	*Outward*
Director	General ...	2,218*	1,198†
	Technical ...	128	171†
Administrative Department	...	4,543	4,081
Botany Department	...	341	274
Plant Pathology Department	...	547	572
Soils Department	...	604	498
Chemistry Department	...	488	413
Smallholdings Dept.	General ...	7,963	11,703
	With Rubber Controller ...	1,125‡	6,244§
Estate Department	...	500	1,260
		18,457	26,414

*Includes 1439 applications for various posts advertised.
†Includes correspondence handled by the Acting Director.
‡Includes New Planting Applications etc.
§Includes 3067 Preliminary Reports, 2024 Final Inspection Reports and 1153 Special Reports etc.

8. NOTES ON DEPARTMENTAL REPORTS

Botany.—The advisory work of the Department has been mainly concerned with the choice of clones for use in replanting programmes and with methods of yield stimulation and of intensive tapping for increased yields.

A number of selected RRIC clones continue to show excellent yields in test tapping and several of these clones, namely RRIC 7, 45, 52, 88 and 89, have been used in replantings carried out on Dartonfield Division during the South-West and North-East monsoons of 1961.

The performance of clone Nab 15 has been excellent in all trials in which it is represented.

A study of the morphological characters of most of the high-yielding RRIC clones was completed during the year.

Preliminary yields have been recorded on old seedling rubber on the Kuruwita Sub-station for the establishment in 1962 of a large-scale yield stimulation experiment on trees tapped on the double-four and double-three systems.

A yield stimulation experiment on old rubber resulted in 45–50% increased yields in 1961.

Crown-budding experiments with clone LCB 870 continue to show an adverse effect of the LCB 870 crown on the yields of the centre section of a number of clones.

The Plant Breeding Section of the Botany Department carried out 38,878 hand pollinations during the 1961 flowering season, a substantial increase over the previous year's programme, obtaining a fruit set of 1860 or 4.7% pollination success. Individual clonal combinations ranged from complete failure to 22.1% success.

Disease control measures on flowers and fruit were more successful than in the previous year.

An innovation was created by the introduction of imported *Dothidella*-resistant clones into the breeding programme with the aim of combining high yield and disease resistance. Eighty seven seedlings of various crosses were obtained.

579 legitimate (hand-pollinated) seedlings of the 1956, 1957, 1958 and 1959 series of crosses were "cloned" at Karapincha nurseries and the clones were established as five-tree and ten-tree clones in a clone trial on Kuruwita Sub-station during the South West monsoon, along with 30 promising foreign clones and clone PB 86 as a control. 253 other clones were established in a further clone trial of 15 acres during the North-East monsoon planting season.

Attempts have been made to induce early flowering for breeding purposes by budding imported clones on to shoots produced from pollarded mature rubber trees of a 1935 planting. Todate 92 clones have been successfully budded on to these trees.

Nursery buddings of 7 *Dothidella*-resistant clones and of 3 RRIC clones ring-barked in 1960 flowered according to plan, thus enabling these clones to be used in the 1961 breeding programme.

The *Oidium* Testing Station, established in 1959 on Kepitigalla Group, was released from fungicidal control at the end of 1960. Screening for *Oidium* resistance of the 151 clones during the period under review showed that 15% of the DR clones, 48% of the clones made from LCB 870 crosses, 12% of the clones made from RRIC 52 crosses and clone RRIC 52 itself possess varying degrees of resistance to the disease.

Growth of the crown-budded clones at the Plant Breeding Station at Monera-gala is progressing satisfactorily. 29 additional clones were added in late 1960 bringing the total to 106 clones. 211 new clones from the 1956–1960 crosses have been established in a neighbouring area along with 8 RRIC clones.

Growth has been satisfactory at the *Phytophthora* Testing Station on Peenkande Group. 152 clones are represented in the test.

Plant Pathology.—The incidence of *Oidium* leaf disease was mild in most districts, the weather conditions during the refoliation period being not conducive to the development of the fungus.

The comparative effectiveness of spraying and of dusting for the control of the disease was investigated in 5 field experiments covering an area of 118 acres and confirmed the previous year's findings that, provided adequate coverage of the foliage is obtained, better control is obtained by spraying than by dusting.

Incorporation of certain chemicals in the wettable sulphur preparations, used as sprays for *Oidium* control, caused a fairly high incidence of flower drop but it is doubtful whether this method of indirect control of *Phytophthora* by reducing fruit set would be either practical or economic on a commercial scale.

The incidence of *Phytophthora* leaf fall was relatively low during the early part of the South West monsoon season but showed a marked increase during the abnormally wet months of August and September.

The most effective method of control would appear to be by spraying rather than by dusting and a water suspension of copper oxychloride to which is added a new low volume formulation has given the best results in our field experiments.

Black Stripe disease caused by *Phytophthora palmivora* was not much in evidence until the later stages of the monsoon when a heavy incidence was reported from some districts.

The incidence of *Gloeosporium* leaf disease has not been serious during the first half of the year although some damage to young shoots and leaves was recorded in a number of young replanted areas.

No serious cases of Pink disease were reported to the Institute during the period under review.

The incidence of White Root disease in young replanted areas remained within normal limits. A questionnaire on the effect of Tillex treatment, returned by 84 estates revealed the high effectiveness of Tillex in the control of White Root disease, early treatment with the chemical resulting in 75 to 80 per cent of cures.

Soils.—Thirty field experiments to test under Ceylon conditions the value of the method of Physiological Diagnosis for the diagnosis of the fertilizer requirements of rubber plants are in progress on collaborating estates and the analyses of leaf and latex samples collected from these experimental areas form a major part of the work of the laboratory staff of the Department.

Eight other manurial trials were in progress on estates during the year and four new experiments, two on a collaborating estate and two on the RRIC Kuruwita Sub-station, have been laid down in replantings during the South West monsoon of 1961.

Application of a NPK + Mg fertilizer mixture to the planting hole would seem to be more beneficial than that of rock phosphate or of animal meal.

An investigation into variations in the level of mineral content in a number of recommended clones is in progress.

A nursery manurial trial has shown that it is possible by adopting a system of land rejuvenation and intensive manuring to bring nursery seedlings to buddable size in about 10 months from planting.

The new herbicide "Paraquat" has been found to be effective as a total weed killer at the concentrations recommended by the suppliers.

A meteorological station has been installed at Dartonfield and regular records are being kept.

In addition an automatic siphon rainfall recorder has been installed at ten different locations of the rubber growing areas.

Chemistry.—A systematic study of the latex and rubber of 20 clones is in progress. Monthly samples of the latex are tested for dry rubber content, total solids, percentage of yellow fraction and viscosity at 30°C and the total solids are tested for ash, nitrogen, water extract, acetone extract, caustic potash extract, copper, iron, manganese, magnesium, phosphorus, calcium and potassium.

The crepe made from the latex of each clone has been tested for colour and plasticity.

Considerable interest has been shown by estates regarding the use of "Detergent 40E" and trisodium phosphate in reducing the dirt content of scrap rubber.

It has been found that Robin Blue used at concentrations of 2½ to 3 per cent in diluted Antimucin WB solution acts as a good indicator without staining the scrap crepe.

Crepe rubber manufactured on five estates has been sampled weekly and tested for dirt, copper, manganese, iron and ash. Treatment of scrap rubber for the reduction of copper and manganese content has been successfully carried out.

Investigations on carotenoids and enzymes in clonal latices are in progress.

A microscopic study of the non-rubber particles present in fresh latices of a number of clones has shown differences in the amount and type of these particles.

The advisory services of the Department have been in great demand during the year.

Smallholdings.—The Smallholders' representative on the Rubber Research Board and the Chief Advisory Officer Smallholdings made a tour of inspection of smallholders' replantings in the Northern Sector from 14 to 17 February.

The numerous demonstrations given by Rubber Instructors included sheet making, tapping, disease control, lining, manuring, planting of cover plants, cutting contour drains and after-care of young rubber plants.

As in previous years considerable assistance has been given by this Department to the Rubber Replanting Subsidy Scheme. 31,621 visits to smallholders' replantings and 5,161 visits to new planted areas were paid by the Field Staff. 2,609 replantings totalling 3,779 acres were lined for soil conservation works and 2,991 replantings totalling 4,235 acres were lined for planting holes. The Field Staff marked tapping cuts on 29,002 trees in 509 replanted smallholdings and, in the course of random checks of planting material issued from Commodity Purchase Depots, examined 24,854 stumps.

In new-planted areas 10,252 visits were paid by the Field Staff who lined 655 new plantings totalling 902 acres for soil conservation works and 696 new plantings totalling 979 acres for planting holes.

Rubber Instructors marked tapping cuts on 7,029 trees in 124 new-planted holdings.

3,067 Preliminary Inspection reports and 2,024 Final Inspection reports were sent to the Rubber Controller for purposes of registration of these new plantings.

The State-Aided Co-operative Sulphur Dusting Scheme functioned on an increased scale during the 1961 *Oidium* season. 2,592 holdings totalling 8,835 acres were dusted by 86 co-operative groups using 117 machines, at an all-in cost per acre of Rs. 12/39.

The Publicity Unit of the Department continued to function satisfactorily and in order to attract the crowds, consideration is being given to the showing of cine films instead of lantern slides.

A survey of the economics of a replanted smallholding and of undergirth trees in tapping were in progress during the year.

Estate.—The Institute's stations of Dartonfield, Nivitigalakele and Hedigalla have a planted acreage of 1,009 of which 685 acres were tapped during the year, giving an average yield of 616 lb of dry rubber per acre.

There are approximately 304 acres of immature rubber, including the 31½ acres replanted on Dartonfield during the year with clones RRIC 7, 52, 88, 89, RRIM 13, PB 28/59 and 86.

Fifteen acres earmarked for replanting on Nivitigalakele Division were lined and holed at 12′ × 20′ and clearing was in progress towards the end of the year.

The rainfall for the year at Dartonfield, Nivitigalakele and Hedigalla Divisions amounted to 175.5″, 160.3″ and 179.8″ respectively.

February was an unusually dry month but the second half of the year was abnormally wet with an evenly distributed rainfall of over 100 inches. There were approximately 40 more wet days than in the previous year.

The incidence of both *Oidium heveae* and *Phytophthora palmivora* was less pronounced than in the preceding year.

The Visiting Agent paid two visits to the Institute's stations during the year.

The switch-over from Direct Current to Alternating Current at Dartonfield was not completed during the year, owing to the non-availability of certain items of electrical equipment.

The Rubber Replanting Subsidy Scheme nursery of 57 acres at Hedigalla provided 44,099 PB 86 budded stumps and 58,208 Tjir 1 seedling stumps for the use of smallholders during the South-West monsoon and North-East monsoon planting seasons.

A Visiting Agent to this nursery was appointed in September 1961.

REVIEW OF THE BOTANY DEPARTMENT

By

C. A. De Silva

SUMMARY

Field Experiments and Laboratory Work.—The total planted acreage of the three experimental stations of the Institute was 1,009 acres in 1961. The major proportion of this acreage is under field experiments of the Botany Department and is supervised by the field staff who work on the research side. The Estate Department attends to the commercial records.

Test tapping is carried out once or twice per month on a per tree basis in recording the yields of 3-tree and 5-tree clones and small size plots of ten trees in other experiments. The large-scale clone trials have plots ranging from 25 to 250 trees per plot and these are test-tapped once a month and the latex is bulked according to plots. The dry weight of rubber per plot is calculated from 50 c.c. samples, taken from the bulked latex, which is coagulated and weighed as dried biscuits or crepe rubber. The 250-tree plots are tapped as commercial tapping tasks by the estate and test-tapping is carried out once a month by the research field staff.

Laboratory investigations have been restricted again in 1961 with the further postponement of the commencement of building operations on the new Botany Block. It is hoped that the new block may be completed by the end of 1962.

A separate report is submitted by the Assistant Plant Breeder on the work of the Plant Breeding Section. 80 acres of the recently acquired Sub-station at Kuruwita have been replanted successfully in 1961 under his supervision.

The accumulated planting material from the pollination programmes of recent years has been included in this replanting programme.

Advisory Work.—The Advisory Work of the Botany Department has appreciably increased in recent years. Advice is given on replanting programmes for large commercial estates and on tapping problems connected with efforts to obtain increased yields from old budded and seedling rubber. In most cases no provision has been made to replant such rubber in the near future.

Carefully considered recommendations have to be made on the use of yield stimulants, rainguards, and methods of high tapping above the normal tapping panel, for obtaining increased yields. Such increased yields must be obtained without premature devitalization of the trees.

Short talks and lectures have been given by the Botanist on 9 occasions in 1961 to visiting University students, Farm School students of the Department of Agriculture, District Planters' Associations, and to the Smallholdings Department.

Seven contributions have been made to the Quarterly Journal of the Institute in 1961 by the Botanist on various aspects of rubber planting.

Tapping Experiments. –Most of the yield stimulation experiments were discontinued in 1961 as the location of these experiments were in areas which were due for replanting in 1961.

A yield stimulation experiment on old budded rubber with the use of 'Dilatex' and an 'RRIC' mixture, has given increased yields of 40 to 50 per cent over the controls in 1961.

The light scraping before the application of stimulants has eliminated the undesirable symptoms of cracking of the treated bark and the possible infection by *Phytophthora*. The necessity for light scraping has been stressed by the RRIM in recent publications.

A large-scale yield stimulation experiment on a 40-acre block was initiated in 1961 in old seedling rubber at the Kuruwita Sub-station. 'Dilatex,' 'Stimulex' and 'Ready-Rub' will be used with control plots of the size of a commercial tapping task.

Performance of Clonal Seedlings and Local Clones.—The hand-pollinated legitimate seedlings from crosses of clones PB 86, Mil 3/2 Wagga 6278, RRIC 8, Hil 28 and Tjir 1 have given an average of 20 lb dry rubber per tree per year with 333 trees in tapping. About 30 per cent of the trees of the crosses made in 1942 have developed Brown Bast to date.

836 legitimate seedling crosses of clone PB 86 have yielded 19.3 lb dry rubber per tree per year at 14 to 15 years of age.

251 legitimate seedling crosses of clone Tjir 1 have yielded 13.6 lb dry rubber per tree per year at 14 years of age.

'Selfed' seed of clone Tjir 1 from a local isolated seed garden planted in 1949 has shown a drop in yield from 11.5 lb to 9.4 lb per tree per year in 1961 with 321 trees in tapping. The poorest yielding trees will be thinned out in 1961 for an improvement in yield in 1962; this would normally be done on a commercial plantation.

Clones RRIC 28, 35, 36, 37, 45, 50, and 75 at 17 to 18 years of age in small-scale trial have given yields of over 40 lb dry rubber per tree per year in 1961; clones 35, 36, 37, 45 and 50 have better secondary characters.

Clone RRIC 41 at 17 years of age shows a distinct drop in yield in 1961 to 28.3 lb per tree per year. The two trees in test-tapping have developed Brown Bast. It would be unwise to discard the clone on this account. Over 500 trees of clone RRIC 41 will be test-tapped in 1962.

Clone Nab 15 has given a yield of 41.8 grams per tree per tapping in the 1952 replanted area, Dartonfield. Clone PB 86 has yielded 28.1 grams per tree per tapping in the same clone trial.

In the second year of tapping clone RRIC 7 has given the high yield of 30.1 grams per tree per tapping in the 1953 large-scale clone trial at Hedigalla with 5 foreign clones in the same trial. 960 to 1,000 trees of each clone are represented in this trial.

Clone RRIC 52 has given in small-scale trial 35.6 lb per tree per year in the 11th year of tapping. The control clone Wagga 6278 has given a yield of 25.9 lb per tree per year in the same clone trial.

In the 1949 clearing, planted 6′ × 45′, clone RRIC 52 shows a drop in yield from 14.4 to 13.9 lb per tree per year. In the same trial clone PB 86 has yielded 15.7 lb per tree per year and clone RRIC 86 has yielded 16. 7 lb per tree per year. Clone RRIC 52 is clearly not suited to close planting in the rows. A spacing of 15′ × 18′ is recommended for this clone.

Two clones, RRIC 88 and 89 have given yields of 25.2 and 21.7 lb per tree per year respectively in the 1946 replanted area, Nivitigalakele. 23 trees of each clone have been test-tapped in 1961. Both clones are appreciably tolerant to *Phytophthora* diseases and have good secondary characters.

Foreign Clones.—Clone RRIM 513 has yielded 9.5 lb dry rubber per tree per year in the 1940 clone trial at Nivitigalakele. It has moderately good secondary characters and retains 21 of the 25 original trees in the 15th year of tapping. In the 1949 clone trial, Hedigalla, clone RRIM 513 has given a yield of 13.4 lb per tree per year with 120 trees in tapping. Clone PB 86, with 107 trees in tapping, yielded 15.7 lb per tree per year in the same clone trial.

Clone IRCI 7 in the 1954 clone trial at Nivitigalakele has yielded 10.2 lb dry rubber per tree per year in the second year of tapping. Clone RRIM 501 has yielded 9.7 lb per tree per year in the same clone trial.

The crown-budding experiment, with the low-yielding clone LCB 870 crown budded on 5 high-yielding clones, has been continued in the 1952 replanted area Dartonfield. The depressing effect of the crown on the yields of the five clones is again clearly indicated in 1961.

Height of Opening Initial Tapping cuts in Budded Rubber.—An experiment with initial tapping at heights of 42″ and 50″ was started in the 1954 replanted area on 18 foreign and local clones. After 10 months of tapping no significant differences have been observed on yield or growth. The average yields were 23.0 and 23.9 grams per tree per tapping at a height of 42″ and 50″ respectively. This experiment will be continued for several years. Girth and bark measurements are included in the detailed review.

Growth Measurements in Immature Areas.—In 1961 girth measurements were taken in all immature areas and in some tapped areas under field experiments at Dartonfield group and outside estates.

Under uniform conditions of growth on replanted land at Dartonfield, Nivitigalakele and outside estates, foreign and local clones have shown satisfactory growth. The poorest growth is found at the Hedigalla Station. The girth measurements for 1961 are summarized in the detailed review.

Replanting Programme.—The 1934, 1936, 1938 and 1939 replanted areas at Dartonfield have been replanted during 1961 for a second time. Large-scale

monoclonal blocks of clones RRIM 513, RRIC 7, RRIC 52, were planted in the 1936 and 1939 replanted areas; clones RRIC 88, 45, and PB 86 were planted in the 1938 replanted area and clones RRIC 89 and PB 28/59 were planted in the 1934 replanted area. Altogether about 30 acres were replanted under the supervision of the Botanist with the collaboration of the Estate Superintendent.

DETAILED REVIEW

1. GENERAL

1.1. Staff.—Mr. C. A. de Silva, Botanist, was on duty up to the end of July 1961, when he retired from the services of the Institute at the end of his final term of contract, on reaching the age limit. He was re-engaged for a further term of 2 years and resumed duties on 1 September 1961. He acted for the Director for a period of 3 months from December 1960 in addition to his own duties.

The Botanist acted again for the Director for a short period while the latter was on duty leave in the United Kingdom in June 1961.

Mr. D. M. Fernando, Assistant Plant Breeder, was on duty during the year under review.

Mr. L. B. Chandrasekera, Assistant Botanist, was on duty during the year. He attended a course at the Radioisotope Centre at the University of Ceylon for one month in November 1961.

Mr. R. Satchuthananthavale, Research Assistant, was on duty throughout the year.

Mr. W. G. V. Fernando, Senior Technical Assistant, and Mr. C. Amaracone, Technical Assistant, were on duty during the year.

1.2. Advisory Work.—The Advisory work has been mainly confined to recommendations on replanting programmes and tapping problems arising from the necessity for obtaining increased yields from old budded and seedling rubber areas, which in many instances have no provision for replanting in the near future.

Carefully considered recommendations have been made for the judicious use of rainguards, yield stimulants, and the more permanent increased intensities of tapping on various types of old rubber for obtaining increased yields, without the risk of a premature devitalization of the tree.

The number of local and foreign visitors to the Institute continues to increase. The various aspects of research carried out by the Botany Department and the Plant Breeding Section are personally discussed and demonstrated at the Institute's Experimental Stations.

Short talks on the more important aspects of rubber cultivation were given to:

(1) The undergraduates of the Faculty of Agriculture of the University of Ceylon.

(2) The Japanese Youth Goodwill Mission to Ceylon.
(3) The staff and students of the Labuduwa Farm School of the Department of Agriculture, Ceylon.
(4) The Soil Conservation Trainees of the Department of Agriculture, Ceylon.

Correspondence:

Inward	...	341
Outward	...	274

1.3. Visits

To Estates	...	8
To Experimental Stations	...	26
To Colombo	...	4

1.4. Meetings.—The writer attended the following meetings to take part in discussions on rubber planting topics and/or to address the meetings on replanting and tapping problems:

(1) Meeting of the Kalutara District Planters' Association
(2) ,, ,, ,, Ratnapura District Planters' Association
(3) ,, ,, ,, Kelani Valley District Planters' Association
(4) ,, ,, ,, Kegalle District Planters' Association
(5) General Committee Meeting of the Planters' Association of Ceylon.
(6) Annual Field Day of the Smallholdings Department of the Rubber Research Institute.

Meetings attended by the Botanist in his capacity as Acting Director will be found in the Director's Review for 1961.

1.5. Publications.—The following articles contributed by the Botanist were published in the Quarterly Journal of the Institute in 1961.

(1) The Performance of RRIC clones under Ceylon Conditions by C. A. de Silva. *Rubb. Res. Inst. Ceylon Quart. J.* 1961, **37**, 1–12.
(2) Tapping of Hevea Rubber by C. A. de Silva. *Ibid*, 1961, **37**, 75–82.
(3) History and Description of Promising RRIC clones by C. A. de Silva and R. Satchuthananthavale. *Ibid*, 1961, **37**, 112–128.

Notes on the following subjects were prepared by the Botanist for publishing under "Planting Topics" and "Question Corner" of the: Institute's Quarterly Journal:

(1) "A Practical Method of Selectively Thinning-out of High Initial Stand of Clonal Seedlings".
(2) "Wind Damage in Rubber Plantations".
(3) "Brown Bast Disease of Rubber".

2. YIELD STIMULATION EXPERIMENTS

The two yield stimulation experiments initiated in 1958 and 1959 in the 1936 replanted area, Dartonfield, had to be discontinued as the areas of location of these two experiments were due for replanting in 1961.

A third stimulation experiment, which was started in 1960 in the 1935 clearing, Nivitigalakele, was continued in 1961.

The yielding capacity of the budded rubber prior to the introduction of the stimulation treatments was 600 lb dry rubber per acre per year. The experiment was carried out in two sections comparing an 'RRIC' mixture and 'Dilatex,' both stimulants formulated with 2, 4, 5-T, with independent controls. The results for 1960 and 1961 are presented below:—

Yield Stimulation Experiment No. 3, 1935 Clearing, Nivitigalakele
Tapped S/2, d/2, 100%
Yield in lb dry rubber

Treatments	RRIC Mixture	control	Dilatex	control
Yield 1960 ...	1,324	1,054	1,722	1,232
As per cent of control ...	126	100	140	100
Yield 1961 ...	1,159	760	1,438	990
As per cent of control ...	152	100	145	100

A fourth large-scale yield stimulation experiment was started in two fields of approximately 40 acres of old seedling rubber at the Institute's Kuruwita Substation by the end of 1961, after a preliminary tapping of the experimental plots on the S/2, d/2, 100% system.

'Stimulex,' 'Dilatex' and 'Ready Rub,' a 2, 4, 5-T preparation for application without scraping the bark, are tested in two fields No. 10 and No. 11 tapped at intensities of 2S/2, d/3, 133% and 2S/2, d/4, 100% respectively. All plots were made up of equal size tapping tasks.

A light scraping of the bark was adopted for the application of the stimulants used on scraped bark.

3. TAPPING EXPERIMENTS

3.1. Tapping Experiment, 1938 Replanted Area, Dartonfield.—A new tapping experiment was started in November 1961 in a 3-acre block of clone PB 86 planted in 1938.

The experiment consists of 4 blocks of 80 trees each, which were tapped for preliminary yields on the S/2, d/2, 100% system. The following 4 tapping systems were introduced in November 1961:—

Block	*Tapping System*
A	S/2, d/2, 100% (control)
B	2S/2, d/4, 100%
C	2S/2, d/3, 133%
D	2S/2, d/3, 133% (one ladder cut)

The treatment D had the high half-spiral cut opened at a height of 100 inches from ground level for tapping with a ladder. The yields of the experimental tapping in November and December 1961, are given below:—

Tapping Experiment, 1938 Replanted Area, Dartonfield
Yield in lb dry rubber, November to December 1961

Treatments	A S/2, d/2, 100%	B 2S/2, d/4, 100%	C 2S/2, d/3, 133%	D* 2S/2, d/3, 133%
Preliminary yields on S/2, d/2, 100%	189	166	161	182
Experimental yields	216	218	257	350
As per cent of control	100	101	119	162

*With one half circumference cut at a height of 100 inches

The preliminary yields of the treatment blocks indicate the yielding capacity of the blocks before the introduction of the tapping treatments. The experimental data for the tapping year will be adjusted for these initial differences in yielding capacity.

The following observations will be made in this experiment on tapping young budded rubber in its second tapping cycle on first renewed bark.

(1) The long term effect of the increased intensities of tapping on the double-three system with and without the high ladder cut.

(2) The economics of production on the single and double-cut system on 100% intensity tapping.

(3) The effect on yielding capacity on the 3-day and 4-day intervals of tapping due to rain interference during wet weather periods.

(4) The difference in yielding capacity of the tapping cut opened at a height of 100 inches compared with that of the cut on the normal tapping panel in the double-cut 2S/2, d/3, 133% system of tapping.

No useful comments can be made on the preliminary results obtained in this experiment. It should be mentioned, however, that the double-four (2S/2, d/4, 100%) is the cheapest tapping system of the four systems on test and that the use of the high ladder cut opened at 100 inches in the double-cut system (treatment D) will reduce the size of the tapping task from the standard task size of 150 trees on a normal double-cut system to one of 75 trees, depending on the terrain of the area to be tapped.

3.2. Test Tapping of Clones and Clonal Seedlings.—The test tapping of clones and legitimate clonal seedlings was continued as in previous years and the results for 1961 are presented in Tables I and II.

The yields of the clonal seedlings in the 1941 and 1942 clearings, Nivitigalakele, are of the same order as those of the previous year. The PB 86 legitimate seedling crosses in the 1943 and 1946 clearings at Hedigalla continue to give promising yields without any selective thinning out of the poorer yielding trees. The PB 86 crosses in the 1947 clearing show a decided improvement in yields in 1961, with an average yield of 17.5 lb per tree per year.

TABLE I

Test Tapping Results of Hand-Pollinated Clonal Seedlings

Tapped S/2, d/2, 100%

RRIC Station	Origin of material	Year of planting	Parentage of Seedling Family	No. of trees tapped 1961	Yield in lb. d.r. per tree per year		No. of trees affected		
					1960	1961	Canker & Bark Rot	Brown Bast	Wind damage
Nivitigalakele	1939 H.P. seedlings	1941	RRIC 8 × Mil 3/2	38–42	16.4	19.0	9	16	3
			RRIC 8 × Wagga 6278	32–33	20.7	19.2	8	14	3
			Control Wagga 6278 (budded)	39–40	15.4	17.1	2	4	1
Nivitigalakele	1940 H.P. seedlings	1942	RRIC 8 × Hil 28	116–121	16.2	14.5	11	31	7
			RRIC 8 × Tjir 1	76–78	18.0	18.1	4	26	18
			Control Wagga 6278 (budded)	54–101	17.2	18.2	3	9	9
Hedigalla	1941 H.P. seedlings	1943	PB 86 × PR 107	20	33.9	28.8	2	5	—
			PB 86 × Tjir 1	25	24.6	21.2	—	7	—
			RRIC 8 × Tjir 16	14	28.3	20.2	—	2	—
			Control Wagga 6278 (budded)	23	25.3	21.1	—	2	—
Hedigalla	1943 H.P. seedlings	1946	PB 86 crosses	80	22.6	20.5	—	5	—
			Control Tjir 1 (budded)	29	19.5	17.5	—	3	1
Hedigalla	1944 H.P. seedlings	1946	PB 86 crosses	124	21.4	19.8	—	21	1
Hedigalla	1945 clonal seedlings	1947	PB 86 crosses	632–585	14.3	17.5	23	24	—
			Tjir 1 crosses	251–227	13.1	13.6	4	10	—
		1949	Tjir 1 selfs	321–309	11.5	9.4	6	6	—

TABLE II

Test Tapping Results of Clones Established from Hand-Pollinated Seedlings

RRIC Station	Origin of material	Year of planting	Clone	No. of trees tapped 1961	Yield in lb d.r. per tree per Year		No. of trees affected			Mean girth* in inches 1961	Bark thickness in mm.	
					1960	1961	Canker and Bark Rot	Brown Bast	Wind damage		Virgin bark	Renewed bark
Nivitigala-kele	1939 H.P. seedlings	1941	RRIC 9	3	25.4	26.1	—	1	1	47.2	12.0	8.3
			,, 51	5	21.9	24.1	1	2	—	48.7	11.1	8.6
			,, 24	5	19.4	24.8	2	—	—	47.2	10.8	8.4
			,, 14	5	15.0	14.2	—	1	—	39.2	11.2	9.8
			Control Wagga 6278			11.1						
Nivitigala-kele	1940 H.P. seedlings	1944	RRIC 28	1	60.9	51.7	1	—	2	53.0	15.0	13.0
			,, 45	2–1	50.4	45.4	1	—	2	44.0	13.0	11.0
			,, 59	3	34.7	39.8	—	—	—	46.1	12.3	10.0
			,, 40	3	34.8	38.3	1	—	—	51.6	14.0	11.0
			,, 31	2–1	39.3	35.6	2	—	1	51.6	13.0	9.0
			,, 39	1	38.3	34.1	1	—	1	45.3	12.0	10.0
			,, 60	3	35.6	32.0	—	2	—	46.0	13.0	10.7
			,, 41	2	51.3	28.3	—	2	—	40.3	12.0	10.5
			Control Wagga 6278	—	—	18.7	—	—	—	—	—	—
Hedigalla	1941 H.P. seedlings	1943	RRIC 75	2	38.1	52.2	1	—	2	43.2	8.9	—
			,, 37	4	54.7	50.8	—	—	—	37.6	9.1	—
			,, 36	3	37.5	44.4	1	—	—	44.4	11.9	—
			,, 50	4	32.9	44.0	—	—	—	44.0	11.3	—
			,, 35	5	33.1	42.9	—	—	—	44.2	11.3	—
			,, 33	5	34.8	39.9	—	—	—	48.1	13.0	10.6
			,, 74	5	29.9	35.8	—	—	—	43.0	11.7	—
			,, 76	4	51.2	32.7	—	—	—	42.0	12.2	—
			,, 79	5	33.8	32.4	—	—	—	45.3	11.0	—
			,, 47	4	42.4	31.1	—	—	—	40.9	9.0	—
			,, 46	3	38.5	30.9	—	—	—	38.4	10.6	—
			Control Wagga 6278		23.3	22.0	—	—	—	—	—	—
Hedigalla	1943 H.P. seedlings	1946	No. 299	2	31.6	33.1	1	1	1	40.1	11.5	10.2
			No. 268	5	35.8	30.6	—	—	—	41.0	11.8	8.8
			RRIC 55	4	32.9	29.4	—	—	1	34.9	10.4	—
			,, 77	3	30.7	29.4	1	1	—	37.6	12.1	—
			,, 61	4	26.8	26.1	—	1	—	35.9	9.7	—
			No. 229	4	32.5	23.3	—	—	1	45.9	10.4	9.5
			No. 241	5	29.9	23.2	—	—	—	32.7	9.5	8.7
			Control Tjir 1		19.8	18.2	—	—	—	—	—	—
Hedigalla	1944 H.P. seedlings	1947	RRIC 64	4	19.7	25.7	—	1	—	34.6	8.9	—
			,, 65	4	25.3	23.0	—	1	—	35.0	10.1	—
			,, 66	5	22.6	19.9	—	—	—	33.8	8.7	—
			,, 78	4	21.5	19.8	—	—	1	31.5	9.7	—

*Girth measurements taken at a height of 4 feet from the union.

The Tjir 1 "selfed" seedlings from a commercial seed garden show a drop in yield in 1961 and require a round of careful selective thinning out of the poorer yielding trees.

In the test tapping results of selected RRIC clones presented in Table II considerable fluctuations in yields of clones are noted from year to year according to the number of trees that are in tapping in the 3-tree and 5-tree clones.

A reduction in the number of trees due to Brown Bast, wind damage and Bark Rot can eliminate at random the better or the poorer yielding trees, thereby causing the yield in pound per tree per year to rise or fall sharply in any particular year. The variation in growth and yield of 3-tree and 5-tree clones in difficult rubber growing land can be very marked under these conditions.

A case in point in 1961 is the reduction in yield of clone RRIC 41 from 51.3 lb per tree per year to 28.3 lb per tree per year. The two trees in tapping have been affected with Brown Bast after 10 years of tapping.

A number of clones in Table II will be in tapping in large-scale clone trials in 1962 and the early results from these trials should help to confirm the results obtained in small-scale trials. There are already indications of the high-yielding characteristics of clone RRIC 36 and 45. Clone RRIC 41 will be tapped on a large scale in 1962.

A close study of the external vegetative characters of most of the selected RRIC clones have been made and the test tapping results of large-scale clone trials from 1962 will permit a reliable selection of the best RRIC clones for commercial planting in the future.

3.2.1. Test Tapping of Clones RRIC 88 and 89.—These clones established from selected PBIG seedlings were planted in the 1946 clone trial at Nivitigalakele for a study of hard and soft rubber. They have been test tapped from 1953 by the Botany Department as potentially high-yielding clones which are also appreciably tolerant to *Phytophthora* diseases.

Test tapping was continued in 1961 and the results are presented below:—

Large-Scale Clone Trial, 1946 Replanted Area, Nivitigalakele
Tapped S/2, d/3, 67% from 1953
Tapped S/2, d/2, 100% from 1956
Yield in lb. dry rubber per tree per year

Clone	RRIC 88	RRIC 89
Yield 1960 ...	22.3	21.2
Yield 1961 ...	25.2	21.7
No. of trees tapped 1961 ...	23	23–21
Brown Bast cases ...	–	2
Wind damage cases ...	1	–
Girth measurements in inches 1961 ...	35.7	33.7
Thickness of Virgin bark (mm.) ...	11.3	9.8
,, ,, Renewed bark (mm.) ...	8.1	6.9

The yields of the two clones continue to be promising in the 9th year of tapping and the secondary characters are very satisfactory. Approximately 3 acres of each clone have been planted in a large-scale clone trial at Dartonfield in 1961.

3.2.2. Test Tapping in 1952 Clearing, Hedigalla 25 Acres, Five-Tree Clone Trial.—625 five-tree clones established from a selection of the 1945 H.P. seedlings are planted in this area. The trees were first tapped commercially in 1959 and a selection of the best yielding trees with good external growth characters was made for test tapping from July 1960. The yields for 1961 are presented below.

Large-Scale Clone Trial, 1952 Clearing, Hedigalla
Tapped from July 1960
Yield in grams per tree per tapping

Clone No.	No. of trees tapped	Yield	Clone No.	No. of trees tapped	Yield
2549	5	74.1	1302	5	50.4
2589	5	66.5	2602	5	49.2
1121	5	58.6	1468	5	47.5
1464	5	55.1	1350*	5	47.0
1360	5	54.2	1522	5	46.7
2530	5	51.1	1084*	5	42.8

*One tree affected with Brown Bast

3.3. Test Tapping of Foreign and Local Clones Established from Imported Clonal Seedlings.—Test tapping was continued in 1961 and the results are presented in Tables III to XIII.

TABLE III

Large-Scale Clone Trial, 1952 Replanted Area, Dartonfield
Tapped S/2, d/3, 67% from April 1958
Tapped S/2, d/2, 100% from 1960
Yield in grams per tree per tapping

Clone	Yield		Girth in inches
	1960	1961	1961
RRIM 501 ...	40.6	44.0	24.7
Nab 15	38.2	41.8	28.2
Nab 12	28.6	30.0	26.0
PB 86 ...	26.2	28.1	25.1
Nab 20	29.1	27.6	25.7
Mean	32.5	34.3	25.9

The 1952 replanted area has been extensively used for building sites and the installation of overhead electric main lines. The number of trees test-tapped have been reduced to 30 to 40 trees of each clone. Clone PB 86 is affected with *Phytophthora* leaf-fall, especially as the adjacent plots are crown-budded with clone LCB 870 which is highly susceptible to *Phytophthora* diseases.

3.3.1. Nab Clones.—The test tapping of two original budgrafts of the Nab clones established from selected Tjikadoe seedlings was continued in 1960. The results are summarized in Table IV.

TABLE IV

1939 Clearing, Nivitigalakele
Test-tapped S 2, d 2, 100% from 1945

Clone	No. of trees tapped 1961	Yield in lb. d.r. per tree per year		No. of trees affected			Girth in inches 1961	Bark thickness in mm.	
		1960	1961	Canker and Bark Rot	Brown Bast	Wind damage		Virgin bark	Renewed bark
Nab 12 ...	16–77	16.2	18.4	2	5	3	36.4	10.2	7.6
Nab 15 ...	17	15.2	14.8	3	5	—	35.5	11.1	7.9
Control PB 86 ...	19	20.5	22.0	—	4	—	37.0	10.3	8.1

Clone PB 86 has been comparatively free of *Phytophthora* diseases in the 1939 clearing. The superior performance of clone PB 86 under these circumstances is not unexpected.

The test tapping results of foreign clones planted in 1940 are presented in Table V.

TABLE V

1940 Clearing, Nivitigalakele
Tapped on S 2, d 2, 100% from January 1947

Clone	No. of trees tapped 1961	Yield in lb. d.r. per tree per year		No. of trees affected			Mean girth in inches 1961	Bark thickness in mm.	
		1960	1961	Canker and Bark Rot	Brown Bast	Wind damage		Virgin bark	Renewed bark
PR 107 ...	14–19	14.2	13.9	12	4	2	33.5	10.9	7.8
RRIM 501 ...	13–12	11.3	13.1	2	8	8	28.3	9.9	7.2
RRIM 513 ...	21–20	9.3	9.5	2	6	—	27.6	9.2	6.7
Control Wagga 6278	19–18	14.8	16.1	5	1	4	32.3	11.6	8.7
Tjir 1 ...	14	12.9	15.4	1	8	6	31.8	10.0	7.5

Clone RRIM 513 retains the highest number of trees after 14 years of continuous tapping. This clone has been recommended as an alternative choice for clone RRIM 501.

The test tapping results of three foreign clones in the 1946 replanted area at Nivitigalakele are presented in Table VI. This area is located in a very exposed and rocky area. The clones are subjected to a severe test against wind damage.

TABLE VI

Large-Scale Clone Trial, 1946 Replanted Area Nivitigalakele
Tapped S 2, d 3, 67% from 1953
Tapped S 2, d 2, 100% from 1956
Yield in lb d.r. per tree per year

Clone	No. of trees tapped 1961	Yield in lb d.r. per tree per year		No. of trees affected			Girth in inches 1961
		1960	1961	Canker and Bark Rot	Brown Bast	Wind damage	
LCB 1320 ...	254–261	13.7	12.7	3	19	68	30.8
PR 107 ...	285–297	13.1	12.6	79	22	19	28.3
Tjir 1 ...	238–242	12.7	12.6	2	22	69	27.4

The test tapping of foreign clones planted in the 1954 clearing, Nivitigalakele, was continued in 1961. The results are presented in Table VIA.

TABLE VI A

Small-Scale Clone Trial, 1954 Clearing, 10 Acres, Nivitigalakele
Tapped S 2, d 2, 100% from March 1960
Yield in lb d.r. per tree per year

Clone	IRCI 10	IRCI 7	PB T-207	PB 6 5	PB 24 3	PB 28 59	PB 24 51	RRIM 501	Mean
Yield 1960 ...	5.6	8.1	6.3	7.8	7.4	11.5	6.0	7.6	7.5
Yield 1961 ...	8.8	10.2	7.0	8.9	8.6	14.2	7.6	9.7	9.4
No. of trees tapped 1961	91–117	148–165	119–147	108–142	127–142	138–155	128–148	142–168	—
Canker and Bark Rot cases ...	—	1	—	1	1	1	—	—	—
Brown Bast cases ...	3	—	1	5	3	5	—	—	—
Wind damage cases ...	17	4	16	3	5	9	2	2	—
Mean girth in inches 1961 ...	21.1	23.1	22.9	22.2	22.6	22.6	22.6	22.2	22.4
Virgin bark thickness in mm. 1961 ...	5.5	5.7	6.5	6.1	6.0	6.3	5.7	6.2	6.0

The yield of clone PB 28/59 is again outstanding in 1961, clone IRCI 7 shows a satisfactory increase in yield and the susceptibility of clone IRCI 10 to wind damage in its country of origin is confirmed in our 1954 clone trial.

The test tapping in the 1944 small-scale clone trial at Hedigalla was continued in 1961, especially for the yields of the 3 trees of the original budgrafts of clone RRIC 52. Out of a total of 5 trees one tree was uprooted in a rain storm and other was destroyed by lightning. The average girth for the 3 remaining trees of RRIC 52 in 1961 is 55.3 inches, and the thickness of virgin bark is 12.3 mm.

The results are presented in Table VII.

TABLE VII

Small-Scale Clone Trial, 1944 Clearing, Hedigalla
Tapped S/2, d/2, 100% from May 1951
Yield in lb d.r. per tree per year

Clone	No. of trees 1961	Yield				Canker and Bark Rot cases	Wind damage cases
		1958	1959	1960	1961		
PB 5/122 ...	4	23.5	23.8	35.5	29.8	—	1
RRIC 52 ...	3	34.5	25.1	31.2	35.6	—	1*
Control Wagga 6278 ...	5	18.5	20.1	26.7	25.9	—	—

*Uprooted

3.3.2. RRIC clones No. 2 to 7.—These clones were selected for trial in a large-scale clone trial in 1945 from 190 3-tree clones established from high-yielding Prang Besar seedlings in 1936 and 1937. Three clones were finally selected for further test tapping with clone Tjir 1 as a control. The results are presented in Table VIII.

TABLE VIII

1945 Clearing, Hedigalla
Tapped S/2, d/3, 67% from 1953 to 1955
Tapped S/2, d/2, 100% from 1956
Yield in lb d.r. per tree per year

Clone	RRIC 4	RRIC 5	RRIC 7	Control Tjir 1
Yield 1959 ...	20.4	20.4	19.8	14.4
,, 1960 ...	17.5	18.8	21.0	17.6
,, 1961 ...	14.2	18.9	18.4	16.6
No. of trees 1961 ...	73–58	74–65	74–72	—
Brown Bast cases ...	2	8	1	1
Wind damage cases ...	15*	2	1	—

*3 trees damaged and 12 trees uprooted

Clone RRIC 4 and 7 show a drop in yield in the 9th year of tapping.

3.4. Test Tapping in 1950/51 Clearing, Hedigalla.—Test tapping was continued in this area in 3 small-scale clone trials with 25-tree plots replicated three to fourfold. The results are presented in Tables IX A, B and C.

TABLE IX A

Trial No. 1 Chemara Clones
Tapped S/2, d/3, 67% from March 1957
Tapped S/2, d/2, 100% from 1960
Yield in lb d.r. per tree per year

Clone	Ch 26	Ch 3	Ch 31	PB 86 Control
Yield 1960 ...	13.2	12.7	11.0	15.5
Yield 1961 ...	24.7	16.6	9.6	14.3
Bark Rot cases ...	—	—	—	—
Brown Bast cases ...	—	1	2	1
Wind damage cases: ...	—	—	—	—
Branch and stem damage	8	1	—	1
Uprooted ...	37	23	5	4

TABLE IX B

Trial No. 2, Small-Scale Clone Trial
Tapped S/2, d/3, 67% from 1958
Tapped S/2, d/2, 100% from 1960
Yield in lb d.r. per tree per year

Clone	RR 134	RR 108	PB 86	RR 116	141/41N	154/41N
Yield 1960 ...	14.0	13.7	12.9	11.3	10.1	9.9
Yield 1961 ...	14.2	15.2	13.3	10.5	10.1	9.8
Bark Rot cases ...	—	—	—	—	—	—
Brown Bast cases ...	2	1	—	—	—	—
Wind damage cases:	—	—	—	—	—	—
Branch and stem damage ...	—	1	1	—	1	—
Uprooted ...	8	8	7	4	6	12

This area is exposed to severe monsoon storms.

Clones RR 108 and 134 will be considered for inclusion in a large-scale clone trial in 1962.

TABLE IX C

1951 Clearing, Hedigalla
Trial No. 3, Small-Scale Clone Trial
Tapped S/2, d/3, 67% from 1958
Tapped S/2, d/2, 100% from 1960
Yield in lb d.r. per tree per year

Clone	PB 86	RR 181	RR 52	RR 119	OY 1
Yield 1960 ...	12.4	10.4	9.1	9.7	6.3
Yield 1961 ...	13.0	8.0	7.5	8.7	3.8
Bark Rot cases ...	2	—	11	—	3
Brown Bast cases ...	1	—	1	1	3
Wind damage cases:	—	—	—	—	—
Stem and Branch damage ...	5	—	3	3	—
Uprooted ...	16	26	17	10	18

In an area which is subjected to severe monsoon storms the plots have been badly depleted of trees by wind damage.

3.5. Test Tapping: Large-Scale Clone Trial, Planted 6′ × 45′, 1949 Clearing, 35 Acres, Hedigalla.—With the elimination from test tapping records of a major number of the 31 clones tested in this area based on growth, yields and other secondary characters, especially, high susceptibility to disease, a selection of the more promising clones were test-tapped in 1961. Older clones have been retained as controls to compare the high-yielding characteristics of the selected clones. Vigorous growing clones with spreading branching habits are not suited to close planting in the rows and the performance of such clones in this clearing must be judged with this aspect in view, especially clone RRIC 52. We recommend a spacing of 15′ × 18′ for this clone giving a stand of 160 planting points per acre.

The results for 1961 are presented in Table X.

TABLE X

Clone Trial, 35 Acres, Planted 6′ × 45′, 1949 Clearing, Hedigalla
Tapped S/2, d/3, 67% from July, 1956
Tapped S/2,/d/2,/100% from 1959
Yield in lb d.r. per tree per year

Clone	No. of trees tapped 1961	Yield		Brown Bast cases	Wind damage cases 1961	
		1960	1961		Branch and Stem	Up-rooted
RRIC 86 ...	84–87	15.1	16.7	4	2	—
Nab 20 ...	85–96	17.2	16.7	4	—	4
RRIM 501 ...	95–102	14.7	16.3	—	5	1
RR 29 ...	117–118	15.7	15.8	—	—	—
PB 86 ...	107	15.0	15.7	2	—	2
RRIC 52 ...	108	14.4	13.9	1	—	—
RRIC 87 ...	125–128	11.0	12.7	3	—	5
RRIM 513 ...	119–120	13.4	12.6	5	—	1
Dar 38 ...	110–111	11.2	11.1	4	—	4

In the 1949 clearing, owing to the big losses of trees due to monsoon storms in the past in the 25-tree plots of each clone, replicated six-fold over 35 acres, the competition for growth within clonal plots and blocks has become very uneven. The yields of the clones of recent years must be compared by taking into consideration the growth factor indicated by the number of surviving trees of each clone and the yields which are presented on a per tree per year basis.

With an initial total of 150 trees per clone, clones RRIC 86, Nab 20 and RRIM 501 have well under 100 trees per clone. Clones PB 86 and RRIC 52 are about equal, and clones RRIC 87 and RRIM 513 have well over 100 trees per clone, especially the former.

3.6. Test Tapping of Large-Scale Clone Trial, 1953 Clearing, 60 Acres, Hedigalla. The clones in this trial are planted in 200-tree and 240-tree plots replicated fivefold and fourfold respectively. Two plots used as tapping tasks, A and B, were taken into tapping when the trees reached the criteria of tappability of 18 inches and 20 inches respectively, while two tapping tasks, C and D, were tapped when the trees reached an average girth of 22 inches, about 12 months after the commencement of tapping on tasks A and B. The yield results for 1961 are presented in Table XI.

TABLE XI

Large-Scale Clone Trial, 1953 Clearing, Hedigalla
Tapped S/2, d/2, 100% from April 1960 (Tasks A and B)
and from March 1961 (Tasks C and D)
Yield in grams per tree per tapping

Clone	Task	Yield		No. of trees affected			
		Task	Mean	Bark Rot	Brown Bast	Wind damage	
						Branch	Uprooted
RRIC 1 ...	A	16.2)		5	1	—	—
	B	18.6)	18.8	2	1	—	—
	C	20.5)		8	—	—	—
	D	19.8)		—	—	—	—
RRIC 2 ...	A	18.7)		6	1	—	—
	B	21.1)	23.5	17	—	—	—
	C	24.8)		1	—	—	—
	D	29.3)		14	1	—	—
RRIC 3 ...	A	15.8)		—	—	—	—
	B	23.6)	22.0	—	—	—	—
	C	23.2)		—	—	—	—
	D	25.5)		—	—	—	—
RRIC 4 ...	A	27.5)		—	—	—	1
	B	22.8)	23.5	—	—	1	—
	C	18.8)		—	—	—	—
	D	25.0)		6	—	—	—
RRIC 5 ...	A	25.2)		—	—	1	—
	B	22.2)	27.6	—	—	—	—
	C	27.1)		—	—	—	—
	D	36.1)		—	—	1	—
RRIC 6 ...	A	26.8)		—	—	—	—
	B	28.6)	29.1	3	—	—	—
	C	29.1)		1	—	—	—
	D	31.9)		—	—	—	—
RRIC 7 ...	A	26.2)		—	—	—	—
	B	22.4)	30.1	—	—	—	—
	C	34.3)		1	—	—	—
	D	37.6)		—	—	—	—
Mean ...	A	22.3		—	—	—	—
	B	22.8		—	—	—	—
	C	25.4		—	—	—	—
	D	29.3		—	—	—	—
RRIM 501 ...	A	22.7)		—	7	—	—
	B	29.1)	26.9	—	1	—	2
	C	25.1)		—	4	—	—
	D	30.8)		—	4	—	—
LCB 1320 ...	A	32.0)		—	5	—	—
	B	27.1)	29.5	—	5	1	2
	C	32.2)		—	3	—	—
	D	26.5)		—	3	—	3
RRIM 513 ...	A	21.6)		—	4	1	2
	B	23.7)	24.9	—	6	—	—
	C	27.9)		—	2	—	1
	D	26.3)		—	2	—	1

TABLE XI—*Contd.*

Clone	Task	Yield		No. of trees affected			
		Task	Mean	Bark Rot	Brown Bast	Wind damage	
						Branch	Uprooted
Tjir 1 ...	A	15.3)		—	4	—	2
	B	17.3)	20.7	—	2	—	—
	C	26.9)		—	1	—	1
	D	23.3)		—	5	1	—
Lun N ...	A	17.3)		—	3	—	1
	B	18.4)	17.9	—	2	—	—
	C	22.4)		—	8	—	2
	D	13.5)		—	5	—	—
Wagga 6278 ...	A	21.8		—	3	—	6
	B	20.6	20.2	—	—	—	3
	C	15.6		—	—	—	1
	D	22.6		—	—	—	3
Mil 3/2 ...	A	13.6		—	1	—	—
	B	19.5	17.5	—	2	—	1
	C	19.1		—	—	—	1
	D	17.9		1	—	—	—
Mean ...	A	20.6		—	—	—	—
	B	22.2		—	—	—	—
	C	24.2		—	—	—	—
	D	23.0		—	—	—	—

The local clones RRIC 1 to 7 show less Brown Bast cases than the foreign and local clones which are planted at higher elevations. The RRIC clones at the lower elevations show more Bark Rot cases.

Clone RRIC 7 has yielded up to the standard of the best of the foreign clones.

Tasks C and D, tapped one year later with a criterion of tappability of 22 inches girth, show a somewhat higher yield than tasks A and B tapped at 18 inches and 20 inches girth, respectively. The differences could be within the limits of experimental errors.

3.7. Test Tapping of Tappable Clones in the 1954 Large-Scale Clone Trial, Hedigalla.—A few clones which had reached tappable girth in this clone trial were test-tapped from July 1961. The preliminary results from July to December 1961 are presented in Table XII.

TABLE XII

1954 Clearing, Hedigalla
First tapped in July 1961 on S/2, d/2, 100%
Yield in grams per tree per tapping

Clone	No. of trees tapped	Yield	Brown Bast cases	Wind damage cases
RRIC 35	596	30.8	—	—
,, 36	486–484	29.8	2	—
RRIM 501	533–531	19.4	2	—
RRIC 26	444	17.9	—	—
,, 22	541–534	17.5	—	7
,, 16	449–448	16.7	—	1
,, 18	531–530	15.3	—	1

The original budgrafts of clones RRIC 35 and 36, which show promising yields as 5-tree clones in the 1943 clearing, Nivitigalakele, (Table II) are yielding very satisfactorily in the 1954 clearing, Hedigalla, under somewhat difficult conditions of growth.

3.8. Tapping Experiment, 1954 Replanted Area, Dartonfield.—Two plots of five trees each of 18 clones were tapped at heights of 42″ and 50″ respectively from the union to observe the adaptability of the Michie-Golledge tapping knife to tapping at a height of 50 inches from ground level compared with the recommended height of 42 inches.

The difference in yields at the two tapping heights is presented in Table XIII, with girth and bark thickness figures.

TABLE XIII

1954 Replanted Area, Dartonfield
Tapped on S/2, d/2, 100% at heights of 42″ and 50″ from the union
Yield in grams per tree per tapping, March to December 1961

Clone	Tapping at a height of 42 inches			Tapping at a height of 50 inches		
	Virgin bark thickness in mm.	Girth in inches at 36″	Yield	Virgin bark thickness in mm.	Girth in inches at 50″	Yield
RRIC 8 ...	6.0	22.3	16.8	6.3	23.3	17.4
,, 54 ...	7.0	24.3	25.5	6.6	25.5	24.1
,, 16 ...	6.3	24.2	14.5	7.3	25.4	12.7
,, 17 ...	7.2	23.3	16.6	7.0	24.5	20.1
,, 36 ...	7.2	22.4	26.6	7.1	22.5	29.8
,, 18 ...	6.1	22.3	13.2	6.2	24.4	14.5
,, 30 ...	7.5	23.0	33.4	7.3	23.6	30.0
,, 20 ...	6.3	22.4	25.0	6.0	22.9	21.2
PBT–207 ...	8.7	24.7	17.3	7.6	24.8	22.2
RRIC 21 ...	5.7	21.9	17.2	5.6	23.8	14.8
PB 28/59 ...	7.5	21.5	52.0	7.7	22.6	55.6
RRIC 22 ...	5.8	22.8	18.7	6.0	22.3	27.8
,, 23 ...	7.0	21.0	17.1	6.1	22.3	18.4
,, 24 ...	6.3	24.7	12.8	6.4	24.8	12.8
,, 26 ...	6.2	21.5	17.6	6.0	22.1	18.4
,, 31 ...	5.3	24.2	19.6	6.1	25.3	28.9
,, 28 ...	6.5	24.1	29.4	6.7	25.3	31.4
PB 24/3 ...	6.5	23.5	27.6	6.2	23.9	23.6
Mean ...	6.6	23.0	22.3	6.6	23.9	23.5

There are no marked differences in the average yield figures at the two heights of tapping in the first year of tapping.

The early yields of clones RRIC 28, 31 and 36 are reassuring while those of clone PB 28/59 are outstanding.

4. GROWTH MEASUREMENTS IN IMMATURE AREAS

Under normal conditions of good growth in this country an average yearly increase of 3 inches in girth can be expected. With even growth the criterion of tappability of 20″ in girth in clones can be obtained about the 7th year of age. In clonal seedlings, with the selective thinning out of the poorest growers, the same criterion of tappability can be obtained 9 to 12 months earlier compared with budded rubber.

Girth measurements in immature areas are taken at a height of 3 feet from the union. Over large experimental areas of a single clone trial, girth measurements are taken on every 5th or 10th tree, according to the number of trees in each clone. The trees earmarked for annual measurements are numbered permanently. The girth measurements can be continued after the trees are taken into tapping; the measurements on tapped trees are taken at a height of 4 feet from the union, above the normal tapping panel.

4.1. Clone Trial, 1953 Clearing, 10 Acres, Nivitigalakele.—Clone RRIC 44 and 45 were budded in the field in 1955 on two-year-old clonal seedling stocks planted in 1953.

The girth measurements of clones RRIC 45 and 44 over a period of 18 months are presented below.

Clone	No. of trees	Mean Girth in Inches		Girth increase
		July 1959	February 1961	
RRIC 45	703	15.3	19.6	4.3
RRIC 44	700	13.4	18.7	5.1

4.2. Large-Scale Clone Trial, 1953 Clearing, 69½ Acres, Hedigalla.—This area was brought into tapping in 1961 and the yield results appear under 3.6.

4.3. Large-Scale Clone Trial, 1954 Clearing, 148 Acres, Hedigalla.—RRIC clones 16 to 37 are planted in this clone trial in monoclonal blocks of 800 to 840 trees, together with control foreign clones.

Blocks	Clone	No. of trees	Girth in Inches		Increase 1960/61
			1960	1961	
J and K	RRIC 26*	840	19.1	21.6	2.5
	,, 22*	800	18.9	21.2	2.3
	,, 35*	840	18.4	21.1	2.7
	,, 24	800	18.5	21.0	2.5
	,, 31	840	18.3	20.2	1.9
	,, 21	800	16.9	19.4	2.5
	,, 29	840	16.4	19.2	2.8
	,, 25	840	16.4	18.7	2.3
	,, 32	800	16.3	18.2	1.9
	,, 23	800	16.1	18.1	2.0
	NL 1	100	15.8	17.3	1.5
	PB 86	800	15.1	17.2	2.1
	RRIC 27	840	15.8	16.9	1.1
	IRCI 10	906	15.4	16.8	1.4
	RRIC 30	840	13.9	16.5	2.6
	PR 107	231	13.7	15.5	1.8
Mean			16.6	18.7	2.1
H	AVROS 255	127	18.0	20.0	2.0
	PR 107	1244	15.5	17.9	2.4
Mean			16.8	19.0	2.2
D and E	RRIC 18*	800	19.6	21.6	2.0
	,, 36*	800	19.0	21.3	2.3
	,, 16*	800	18.0	21.3	3.3
	RRIM 501*	800	18.7	20.9	2.2
	RRIC 34	800	17.5	19.9	2.4
	,, 37	800	17.4	19.8	2.4
	,, 28	800	16.5	19.4	2.9
	,, 19	800	16.1	19.0	2.9
	,, 33	800	16.0	17.7	1.7
	,, 17	800	15.8	17.3	1.5
	,, 20	800	13.2	14.2	1.0
Mean			17.1	19.3	2.2

*Tapped from May 1961.

The girth increments indicate difficult growing conditions in mountainous terrain. A few clones were brought into tapping in 1961. Most of the remaining clones will be test-tapped in 1962.

4.4. Large-Scale Clone Trial, 1955 Clearing, 78 Acres, Hedigalla.—This clone trial includes 12 RRIC clones in large monoclonal blocks of 750 trees of each clone, together with 5-tree clones established from H.P. seedlings. The girth measurements of the RRIC clones are summarized below. The girth increments in 1960/61 are again below expected standards of good growth. At the lower elevations of Hedigalla, on undulating land, the clones have grown evenly and most of these clones will be tapped in 1962.

Average Girth Measurements in Inches

Clone RRIC No.	12	11	9	14	40	49	41	47	43	13	46	50	Mean
Girth 1961 ...	20.7	20.2	20.2	19.9	19.6	19.4	18.6	18.1	17.9	17.8	17.2	17.1	18.9
Girth 1960 ...	17.9	18.2	17.6	17.5	16.2	16.8	16.3	16.1	15.4	14.9	14.7	14.8	16.4
Increase 1960/61	2.8	2.0	2.6	2.4	3.4	2.6	2.3	2.0	2.5	2.9	2.5	2.3	2.5

4.5. Large-Scale Clone Trial, 1956 Clearing, 60 Acres, Hedigalla.—The clone trial was planted in two sections in 300-tree monoclonal blocks of foreign and local clones.

The first section was planted in June 1956 and the second section was planted approximately 4 months later.

Four clones GT 1, WR 101, AVROS 385 and AVROS 427 were also planted in June 1956 in the Dartonfield Division as a supplementary trial. A summary of the girth measurements taken in 1960 and 1961 is given below:—

Average Girth Measurements in Inches

Clone	No. of trees 1961	Girth		Increase 1960/61	Clone	No. of trees 1961	Girth		Increase 1960/61
		1960	1961				1960	1961	
RRIM 618	300	13.7	17.4	3.7	PR 253	300	11.0	13.0	2.1
,, 603	299	13.5	16.8	3.3	,, 258	300	9.5	12.3	2.8
IRCI 9	300	13.6	16.6	3.0	Mean		11.8	14.8	3.0
IRCI 5	300	13.7	16.5	2.8	*RRIC 39	300	10.3	13.7	3.4
RRIM 612	300	12.4	16.0	3.6	*RRIC 42	300	10.8	13.2	2.4
,, 605	299	12.6	15.6	3.0	AVROS 1851	300	10.4	12.6	2.2
PB 86	295	12.3	15.0	2.7	,, 1447	300	9.1	12.4	3.3
RRIC 55	300	11.2	15.0	3.8	RRIC 48	300	8.9	12.1	3.2
AVROS 1191	300	11.9	14.6	2.7	TR 1406	300	9.4	11.8	2.4
PR 252	300	11.9	14.3	2.4	IRCI 3	300	9.3	11.3	2.0
RRIM 617	300	10.7	14.3	3.6	IRCI 1	300	9.2	10.9	1.7
PR 228	295	11.4	14.2	2.8	AVROS 1328	300	8.9	10.6	1.7
RRIC 54	300	11.0	14.1	3.1	IRCI 6	300	7.7	9.3	1.6
PR 247	300	11.0	13.5	2.5	PR 256	300	7.1	8.8	1.7
RRIC 59	295	10.4	13.3	2.9					
PR 257	297	10.3	13.2	2.9	Mean		9.2	11.5	2.3

* Planted approximately 4 months later than the other clones in the Table.

4.6. Small-Scale Clone Trial, 1956 Clearing, Dartonfield, Planted June 1956

Clone	No. of trees 1961	Girth in inches		Increase 1960/61
		1960	1961	
WR 101 ...	274	14.3	16.9	2.6
AVROS 385 ...	294	13.3	16.7	3.4
GT 1 ...	295	13.0	17.0	4.0
AVROS 427 ...	284	11.4	13.8	2.4
RRIC 52 ...	47	15.4	21.0	5.6

Clone RRIC 52 could be tapped in 1962 at 6 years of age.

Clones AVROS 385 and GT 1 have grown well in 1960/61 on a steep and rocky mountainous side.

4.7. 1957 Clearing 17¼ Acres, Hedigalla.—This area was planted in the North-East monsoon planting season of 1957 in September-October. Ten-tree

clones established from H.P. seedlings from the 1945, 1954 and 1955 hand-pollination programmes are compared with ten-tree plots of clone PB 86 planted at suitable intervals.

1957 Ten-Tree Clone Trial, Hedigalla

		1960	*1961*
No. of trees	...	2,855	2,772
Girth in inches September 1961	...	5.5	7.6
Girth increase 1960/61	...		2.1

The growth in this area remains below the standards of good growth normally found in replanted areas. The virgin land at Hedigalla in this 17¼-acre block is extremely poor and further attempts will be made to improve the growing conditions in 1962.

4.8. Clone Trials on Commercial Estates

4.8.1. 1957 Replanted Area, Small-Scale Clone Trial, Estate A, Kalutara District.—This clone trial was planted in 300-tree blocks on 10 acres in May-June 1957. Girth measurements were taken in February 1961. The average girth measurements of the five foreign clones and of the control clone PB 86 are given below:—

Average girth in inches (10-acre block)

Clone	TR 1406	AVROS 529	IRCI 2	IRCI 3	RRIM 607	PB 86 Control	Mean
Girth 1961 ...	13.5	12.0	12.5	11.5	11.8	11.0	12.0
Girth 1960 ...	8.2	8.0	7.5	7.0	6.2	7.2	7.3
Increase 1960/61	5.3	4.0	5.0	4.5	5.6	3.8	4.7

4.8.2. 1957 Replanted Area, Clone Trial, Estate B, Kalutara District.—This clone trial was planted in May-June 1957 with 300-tree blocks of each clone to serve as a tapping task in later years.

Girth measurements, taken in February 1961, are summarized below for two blocks of 10 acres and 20 acres each.

Average girth in inches (10-acre block)

Clone	TR 1548	RRIM 612	AVROS 2037	AVROS 1734	PR 254	PB 86 Control	Mean
Girth 1961 ...	15.5	15.5	15.0	15.0	14.3	13.3	14.8
Girth 1960 ...	10.5	10.0	10.0	10.0	10.0	9.2	10.0
Increase 1960/61	5.0	5.5	5.0	5.0	4.3	4.1	4.8

Average girth in inches (20-acre block)

Clone	RRIC 75	RRIM 603	RRIM 602	RRIC 76	RRIM 623	RRIM 622	RRIC 60	TR 1542	RRIC 61	WR 101	PR 248	PB control	Mean
Girth 1961	15.5	14.0	14.8	14.0	14.3	14.0	14.0	13.8	13.8	13.8	12.5	12.4	13.9
Girth 1960	11.2	10.7	10.5	10.2	10.2	10.2	10.0	9.8	9.8	9.8	8.8	9.2	10.0
Increase 1960/61	4.3	3.3	4.3	3.8	4.1	3.8	4.0	4.0	4.0	4.0	3.7	3.2	3.9

4.8.3. 1958 Replanted Area, Clone Trial, Estate B, Kalutara District.— This clone trial was planted in August-September 1958. Eighteen foreign and local clones were planted in 300-tree blocks of each clone. Girth measurements were taken in August 1961. The results are summarized below:—

Average girth in inches (31-acre block)

Clone	RRIC 52	RRIC 54	RRIC 41	IRCI 2	RRIC 22	RRIC 28	GT 1	RRIC 45	AVROS 385
Girth 1961 ...	9.3	10.3	11.0	10.0	10.0	8.3	10.0	10.3	9.3
Girth 1960 ...	7.0	7.0	7.0	6.8	6.8	6.8	6.5	6.5	6.3
Increase 1960/61 ...	2.3	3.3	4.0	3.2	3.2	1.5	3.5	3.8	3.0

Clone	RRIM 605	RRIC 37	IRCI 6	RRIC 39	AVROS 427	RRIC 36	RRIM 607	RRIC 55	PB 86 control
Girth 1961 ...	9.8	10.0	9.0	8.0	9.3	8.8	10.0	8.3	8.3
Girth 1960 ...	6.3	6.3	6.0	6.0	5.8	5.8	5.8	5.5	5.8
Increase 1960/61 ...	3.5	3.7	3.0	2.0	3.5	3.0	4.2	2.8	2.5

5. CROWN-BUDDING INVESTIGATIONS

5.1. Large-Scale Clone Trial, 1952 Clearing, 35 Acres, Dartonfield: Effect of Crown Budding on the Growth of Budded Centre Sections.— The 35-acre area has been used extensively for buildings and electric main lines. Ten-tree plots have been used for comparing five clones crown budded with clone LCB 870 and not crown budded.

Clone LCB 870 is an extremely low-yielding clone which has been used for crown budding because of its resistance to *Oidium*. In more recent years this clone has, however, been affected with *Oidium* at the higher elevations.

The results for 1961 are presented below:—

Crown-Budding Experiment
1952 Replanted Area, Dartonfield
Yield in grams per tree per tapping

Clone	Trees not crown budded	Trees crown budded
PB 86 ...	28.1	17.0
RRIM 501 ...	44.0	21.9
Nab 12 ...	30.0	16.8
Nab 15 ...	41.8	21.7
Nab 20 ...	27.6	18.6
Mean ...	34.3	19.2

Crown budding with the low-yielding clone LCB 870 results in a loss in crop of 44% under the conditions of this experiment.

The average girth of trees not crown budded and that of the crown-budded trees was 25.9 and 23.5 inches respectively. The crown-budded trees showed a set-back in growth from the year of crown budding (1954) and were tapped one year after the trees that were not crown-budded.

This depressing effect of low-yielding crowns on the yield of high-yielding centre-sections has also been shown in the 1945 large-scale crown-budding experiment which was discontinued in 1961.

6. LABORATORY AND FIELD INVESTIGATIONS

The laboratory work was restricted to anatomical and physiological studies by the Assistant Botanist and the Research Assistant under the supervision of the Botanist.

Field investigations were mainly on tapping problems arising out of advisory work.

7. REPLANTING PROGRAMMES

The 1934, 1936, 1938 and 1939 replanted areas at Dartonfield have been replanted during 1961 for a second time. Large-scale monoclonal blocks of clones RRIM 513, RRIC 7, RRIC 52, were planted in the 1936 and 1939 replanted areas; clones RRIC 88, 45, and PB 86 were planted in the 1938 replanted area and clones RRIC 89 and PB 28/59 were planted in the 1934 replanted area. Altogether about 30 acres were replanted under the supervision of the Botanist with the collaboration of the Estate Superintendent.

REVIEW OF THE PLANT BREEDING SECTION

By

D. M. Fernando

SUMMARY

Hand pollinations were carried out on an increased scale over last year's programme. *Dothidella*-resistant material was incorporated for the first time in the annual breeding programme as a result of parallel work carried out in flower induction. Phytosanitation of flowers and fruit was improved this year. Eighty seven seedlings were obtained as a first test series for *Dothidella*-resistance.

Progeny from the 1956, 1957, 1958, 1959 and 1960 hand-pollination programmes was 'cloned' at Karapincha nurseries for planting at Kuruwita Substation. Clones of promising foreign material were also successfully budgrafted for inclusion in this trial.

Flower inducement methods were used to obtain seven *Dothidella*-resistant clones and three local clones for current breeding work.

A screening of the 1959 planting of the *Oidium* Testing Station on Kepitigalla Group was carried out and the results were used to modify the current breeding programme regarding *Oidium* resistance. Routine attention was given to the Breeding Station on Moneragalla Group and the progress of the second series of budgrafts noted. A supplementary Breeding Station *cum* Clone Trial was also initiated on Kumarawatte Group in the Moneragala District.

Routine attention was given to the *Phytophthora* Testing Station on Peenkande Group and a census of the area was taken.

DETAILED REVIEW

1. GENERAL

1.1. Staff

The Assistant Plant Breeder, Mr. D. M. Fernando, was on duty throughout the year.

Mr. C. Amaracone, Technical Assistant (Botany Department), continued to assist in the clerical duties of the Section.

Mr. D. S. Gamage, Field Assistant, was on duty throughout the year and worked at Nivitigalakele and at Kuruwita and Karapincha.

Mr. W. D. Armon, Field Attendant, carried out field operations at Hedigalla with the assistance of Mr. H. B. H. de Silva (Field Assistant, Botany Department) and also helped with work at Nivitigalakele.

Special mention is due to Mr. L. P. de Mel, Senior Field Assistant, Kuruwita, and Mr. H. A. Mendis, Senior Field Assistant, Nivitigalakele, for the co-operation given this Section during the period under review.

1.2. Buildings

The plans for a store room were completed and await tender.

2. HAND POLLINATION PROGRAMME

The hand-pollination programme this year was notable by a major step forward in the successful incorporation of modern *Dothidella*-resistant material. The use of this material is a result of successful experiments in early flower inducement and gives a lead for work in this direction on a bigger scale in future.

Clones used as female parents at each Station were:

Hedigalla:—Ch 26, LCB 1320, PB 86, RRIC 36, RRIC 52, Wagga 6278.

Nivitigalakele:—F 4542, FB 3300, FX 349, FX 4098, IAN 45 710, IAN 45–873, LCB 1320, PR 107, RRIC 36, RRIC 45, RRIC 52, RRIC 88, Tjir 1.

The programme was designed to establish lines of material incorporating *Dothidella*-resistance, *Phytophthora* tolerance and high yield. Breeding for *Oidium* resistance was narrowed into lines based on early screenings carried out at the *Oidium* Testing Station on Kepitigalla Group. The data of the hand-pollination programme are summarized in Table I.

Flower transport using Dewar flasks was found adequate in implementing inter-station breeding. A total of 38,878 hand pollinations were carried out during the season.

A count of fruits in May showed a set of 1860 or 4.7% success. Individual clonal combinations ranged from complete failure to 22.1% success of set, as in the cross Ch 26 × RRIC 52. The failure of many crosses of *Dothidella*-resistant material to set is attributed to the small number of flowers available for hand pollination; larger-scale flower induction is indicated in this regard.

Disease control on flowers was satisfactory using early sprays of Karathane against *Oidium heveae*, and Fermate and Aluminium salts against *Gloeosporium alborubrum* build-up. Disease control of fruits was more effective than in the previous year owing to the early protection against *Oidium*. A further measure adopted was avoidance of large quantities of sticker during frequent spray rounds. It was felt that use of the sticker at this time would hinder the drying of the fruit after heavy rains. Fairly rigid polythene covers were placed over fruits in May and some effectiveness of this method in helping to control *Phytophthora* rot is noted.

The weather was fortunately not too unfavourable for the developing fruits, but some damage was caused by wind. Although the set was not much higher than in the 1960 season, favourable weather and improved phytosanitation combined to give a harvest of more than double the number of seed collected last year and almost double the number of successfully germinated seedlings. A promising set of eighty seven seedlings was obtained as a first test series for *Dothidella* resistance.

3. ESTABLISHMENT OF CLONE TRIALS

A small-scale clone trial was established at Kuruwita Sub-station during the year. By courtesy of the Land Commissioner and the Director of Agriculture stocks were made available at Karapincha for the trial; budwood was transported from Nivitigalakele to Karapincha for budgrafting.

The majority of clones were established as ten-point plantings. However where less than ten budgrafts were available a five-point planting was effected. In those instances where almost twenty budgrafting successes were available an additional five-point replication of the initial ten-point planting was made.

TABLE I

Hevea Hand-Pollination Programme, 1961

(SS) Denotes selected seedling of unknown parentage

Station	Cross	Parentage	No. of pollinations	No. of successes	% success	No. of fruits harvested	No. of seeds collected	No. of seeds germinated	% germination
Hedigalla	Ch 26 × RRIC 36	(BR 2 × BR 2) × (PB 86 × PR 107)	960	62	6.4	60	179	99	55.3
,,	Ch 26 × RRIC 52	,, × (SS)	1,245	276	22.1	247	741	287	38.7
,,	Ch 26 × Wagga 6278	,, × ,,	174	8	4.5	4	11	10	90.9
N'Kele	FX 349 × RRIC 36	(F 4542 × Tjir 1) × (PB 86 × PR 107)	19	3	15.8	2	6	6	100.0
,,	FX 349 × RRIC 52	,, × (SS)	56	3	5.3	3	9	5	55.5
,,	IAN 45–873 × RRIC 52	(PB 86 × FA 1717) × ,,	17	2	11.6	—	—	—	—
,,	LCB 1320 × LCB 1320	(SS) × ,,	114	3	2.6	2	6	6	100.0
,,	LCB 1320 × RRIC 51	,, × (RRIC 8 × Mil 3/2)	203	24	11.8	5	15	12	80.0
,,	LCB 1320 × RRIC 52	,, × (SS)	178	18	10.1	6	18	14	77.7
Hedigalla	LCB 1320 × RRIC 52	,, × ,,	601	105	17.4	38	115	95	82.6
N'Kele	LCB 1320 × Tjir 1	,, × ,,	33	2	6.0	2	6	3	50.0
,,	LCB 1320 × Wagga 6278	,, × ,,	10	1	10.0	—	—	—	—
Hedigalla	LCB 1320 × Wagga 6278	,, × ,,	121	5	4.1	3	9	9	100.0
,,	PB 86 × Ch 26	,, × (BR 2 × BR 2)	3,597	123	3.4	79	236	174	73.7
,,	PB 86 × RRIC 52	,, × (SS)	658	3	.4	1	3	3	100.0
,,	PB 86 × RRIC 86	,, × ,,	372	16	4.3	12	36	31	86.1
N'Kele	PR 107 × LCB 1320	,, × ,,	59	1	1.6	—	—	—	—
,,	PR 107 × PR 107	,, × ,,	143	1	.7	1	3	—	—
,,	PR 107 × RRIC 52	,, × ,,	970	15	1.5	9	27	13	48.1
,,	PR 107 × Wagga 6278	,, × ,,	82	1	1.2	1	3	—	—
Hedigalla	RRIC 36 × Ch 26	(PB 86 × PR 107) × (BR 2 × BR 2)	212	5	2.3	5	15	15	100.0
,,	RRIC 36 × T 180	,, × (LCB 870 × PB 86)	20	1	5.0	1	3	2	66.6
,,	RRIC 36 × T 290	,, × ,,	22	1	4.5	1	3	2	66.6
N'Kele	RRIC 36 × T 290	,, × ,,	28	2	7.1	—	—	—	—
,,	RRIC 36 × RRIC 52	,, × (SS)	90	6	6.6	4	11	—	—
Hedigalla	RRIC 36 × RRIC 52	,, × ,,	79	4	5.0	4	12	10	83.3
N'Kele	RRIC 36 × RRIC 88	,, × ,,	39	3	7.6	1	3	3	100.0
,,	RRIC 45 × FX 4098	(RRIC 8 × Tjir 1) × (PB 86 × B 74)	143	7	4.8	7	21	18	85.7
,,	RRIC 45 × IAN 45–873	,, × (PB 86 × FA 1717)	157	14	8.9	9	27	22	81.4
,,	RRIC 45 × LCB 1320	,, × (SS)	437	36	8.2	17	49	40	81.6
,,	RRIC 45 × Wagga 6278	,, × ,,	370	46	12.4	22	67	54	80 5

TABLE I—(*Contd.*)

Station	Cross	Parentage	No. of pollinations	No. of successes	% success	No. of fruits harvested	No. of seeds collected	No. of seeds germinated	% germination
N'Kele	RRIC 52 × Ch 26	(SS) × (BR 2 × BR 2)	240	6	2.5	1	3	3	100.0
Hedigalla	RRIC 52 × Ch 26	,, × ,,	5,642	102	1.8	44	132	100	75.7
,,	RRIC 52 × FX 349	,, × (F 4542 × Tjir 1)	623	2	.3	2	6	4	66.6
N'Kele	RRIC 52 × FX 4098	,, × (PB 86 × B 74)	683	28	4.0	3	9	7	77.7
,,	RRIC 52 × IAN 2833	,, × (FX 516 × PB 86)	53	3	5.6	2	6	1	16.6
,,	RRIC 52 × LCB 1320	,, × (SS)	1,596	77	4.8	6	18	10	55.5
Hedigalla	RRIC 52 × LCB 1320	,, × ,,	2,592	272	10.4	45	135	88	65.2
,,	RRIC 52 × PB 86	,, × ,,	267	6	2.2	4	12	12	100.0
,,	RRIC 52 × RRIC 36	,, × (PB 86 × PR 107)	3,227	72	2.2	27	81	47	58.0
N'Kele	RRIC 52 × RRIC 52	,, × (SS)	1,558	39	2.5	3	9	7	77.7
Hedigalla	RRIC 52 × RRIC 86	,, × ,,	745	21	2.8	10	30	16	53.3
,,	RRIC 52 × RRIC 88	,, × ,,	433	25	5.8	17	51	43	84.3
,,	RRIC 52 × T 180	,, × (LCB 870 × PB 86)	176	6	3.4	3	9	7	77.7
,,	RRIC 52 × T 290	,, × ,,	138	3	2.1	2	6	2	33.3
,,	RRIC 52 × Wagga 6278	,, × (SS)	2,819	196	6.9	47	141	86	60.9
N'Kele	RRIC 52 × Wagga 6278	,, × ,,	221	5	2.2	1	3	—	—
,,	RRIC 88 × FX 4098	,, × (PB 86 × B 74)	375	9	2.4	8	24	21	87.5
,,	RRIC 88 × IAN 45–710	,, × (PB 86 × F 409)	17	1	5.8	1	3	3	100.0
,,	RRIC 88 × RRIC 36	,, × (PB 86 × PR 107)	648	55	8.4	50	149	112	75.1
,,	RRIC 88 × RRIC 52	,, × (SS)	244	9	3.6	9	27	15	55.5
,,	RRIC 88 × T 180	,, × (LCB 870 × PB 86)	91	9	9.8	9	27	26	96.2
,,	RRIC 88 × T 290	,, × ,,	155	9	5.8	9	27	19	70.3
,,	Tjir 1 × Ch 26	,, × (BR 2 × BR 2)	682	7	1.0	5	15	3	20.0
,,	Tjir 1 × LCB 1320	,, × (SS)	246	7	2.8	5	15	7	46.6
,,	Tjir 1 × RRIC 52	,, × ,,	535	27	5.0	25	75	25	33.3
Hedigalla	Wagga 6278 × LCB 1320	,, × ,,	636	52	8.1	16	48	5	10.4
,,	Wagga 6278 × RRIC 52	,, × ,,	247	15	6.0	9	27	10	37.0
		TOTAL ...	36,098	1,860	5.1	909	2,722	1,612	59.2
		Unsuccessful Crosses							
Hedigalla	Ch 26 × T 290	(BR 2 × BR 2) × (LCB 870 × PB 86)	12						

TABLE I—(*Contd.*)

Station	Cross	Parentage	No. of Pollinations	No. of successes	% success
N'Kele	F 4542 × RRIC 10	(SS) × (Mil 3/2 × Wagga 6278)	5		
,,	F 4542 × RRIC 52	,, × (SS)	7		
,,	FB 3300 × FX 349	,, × (F 4542 × Tjir 1)	6		
,,	FX 349 × FB 3300	(F 4542 × Tjir 1) × (SS)	3		
,,	FX 4098 × Ch 26	(PB 86 × B 74) × (BR 2 × BR 2)	8		
,,	FX 4098 × LCB 1320	(PB 86 × B 74) × (SS)	19		
,,	FX 4098 × RRIC 52	,, × ,,	17		
,,	FX 4098 × T 290	,, × (LCB 870 × PB 86)	3		
,,	IAN 45–710 × RRIC 88	(PB 86 × F 409) × (SS)	3		
,,	IAN 45–710 × RRIC 52	,, × ,,	2		
,,	IAN 45–873 × Wagga 6278	(PB 86 × FA 1717) × ,,	6		
,,	LCB 1320 × Ch 26	(SS) × (BR 2 × BR 2)	33		
Hedigalla	PB 86 × LCB 1320	,, × (SS)	93		
,,	PB 86 × RRIC 36	,, × (PB 86 × PR 107)	132		
,,	PB 86 × RRIC 88	,, × (SS)	293		
,,	PB 86 × T 180	,, × (LCB 870 × PB 86)	158		
,,	PB 86 × T 290	,, × ,,	138		
N'Kele	PR 107 × FX 4098	,, × (PB 86 × B 74)	27		
,,	PR 107 × RRIC 10	,, × (Mil 3/2 × Wagga 6278)	32		
,,	RRIC 36 × FX 4098	(PB 86 × PR 107) × (PB 86 × B 74)	27		
,,	RRIC 36 × RRIC 86	,, × (SS)	20		
,,	RRIC 52 × FX 4098	(SS) × (PB 86 × B 74)	81		
,,	RRIC 52 × IAN 45–873	,, × (PB 86 × FA 1717)	45		
Hedigalla	RRIC 52 × IAN 45–873	,, × ,,	54		
,,	RRIC 52 × RRIC 52	,, × (SS)	1,310		
N'Kele	Tjir 1 × FX 4098	,, × (PB 86 × B 74)	35		
,,	Tjir 1 × Tjir 1	,, × (SS)	109		
,,	Tjir 1 × Wagga 6278	,, × ,,	60		
			2,726		
		GRAND TOTAL ...	38,878	1,860	4.7

The material laid out on trial at Kuruwita Sub-station during the South West monsoon was as follows:—

South-West monsoon planting

( ) five-point planting
* five-point replication additional to ten-point planting.

1956 Progeny

Family	Clone Nos.
RRIC 8 × RRIC 45	1*
RRIC 8 × PR 107	3*, 4*, (5)
RRIC 8 × Mil 3/2	(10)
RRIC 8 × (PB 86 × AVROS 157)	17*
AVROS 157 × RRIM 501	29*, 33*, 34, 35*, 36, (37), (39)
AVROS 157 × RRIC 8	54, 57
RRIC 41 × RRIC 10	82, 84

1957 Progeny

AVROS 163 × T 1968	200, 202, 203*, 204*, 206, 208, 210, 212*, 213*, 215*, 216*, 218*, 219, 220, 222*, 223, 224*, (225), 227*, (228).
PB 86 × RRIC 38	236*, 237, 238*, 240*, 242, 243*, 244*, 245, 246* (249), 250, 251.
Mil 3/2 × Tjir 1	253, 254*, 255*, 258*, 261*, 264*, 266*, 272*
RRIC 52 × PB 5/139	(275).
Wagga 6278 × Tjir 1	277, 279, 280.
Tjir 1 × RRIC 50	281, 282*, 284*, 287, (288), 289*, 292*, 295*, 297*, 299*, 302, 305, (308), 309*, 313, (316), 321, 322, 324, 328*, 333*, 335*, 339, 343*, 346, (350), 353*, 354, 357, 358, 359*, 362*, 363*, (364), 369*, 374, 383, 386*, 390, 391*, 396, (397), 400, 403*, 404, 407*, (408), 409*, 412, (413), 414*, 417, 418, (419), 420, 421.
RRIC 52 × PB 86	423*, 424*, 426*, 427, 428, (430), 432, 434*, (435), 437, 438, 439, (441), (442), 445, (447), 450, (453), 454, (456), 457*, 459, 465*, (467), 469*, (473), (474), (477), 478, 479*, (482), (488), 492, 493, (495), 497, (498), 500, 503, 505, 506*, (508), 510, (511), 513, (514), 515, (516), 517, 520*, 521, 523, 524, (529), (532), (533), (534), 536, 537, (539), 540, (544), 545, 546, 547, 548, 550*, 551*, 552*, 554, 555*, 556*, 559*, 560, 565, 570, 571, 572, 574, 578*, 584*, 585*, 590*, 592*, 595*, 597*, 603*, 604*, 605*, (608), 609), (611), 615, (633), 617, 624*, 630*, 632*, 635, 642*, 643*, 647*, 648*, 649*, 652, 653, 655*, (656), 657*, 569*, 660, 661, 662, 663*.
AVROS 163 × T 841	664*, 665*, 666, 669*, 670, (671), 672, 673, (676), (679), 680, 681, 683*, (684), (685).
PB 86 × RRIC 52	686*, 687, 688, 689*, 690*, 692*.
PB 86 × RRIC 36	693*, 694*, 695, 696*, 698*, 700*, 702, 703, 707, (708), 710, 711, (713), 714*, 715, 717*, 719, 721, 722*, 723, 724*, 725*, 726*, 727.
RRIC 52 × Tjir 1	731*, 732*, 733*, 734, 736, 737, 743*, 749*, 751*, 755, 756, (761), 762*, 763*, 765*, 766*, 771*, 772*, 774, (778), (780).
PB 5/139 × RRIC 52	785*, 786, (791), 792, (794), 795, 797*, 799, 802, 803, 804, 806, 807, 809, 810*, 813, 814, 817, 818, (822), 823, 825, 826*, 829*, 831, 833*, 836*, 837, 840, 841*, 844*, 853, (859), 861, (863), 865, 867, (868), (869), 873*, 874, (875), 878, 881, 883, 885*, 886, (887), 890, 892.

Family	*1958 Progeny*
PB 86 × T 306	(901), 902, 903, 904*, 905, 906*, 910, 911, 912*, 913, 915*, 916, 920*, (922), 925*, 926, 927, 929, 930, (931), 932, (933), 934*, 935*, 937, 938, 940, 941, 942*.
PB 86 × T 243	988, (989), (990), (993), (995), 996, 997, (998), 999, 1000*, (1001).
T 237 × RRIC 52	1003.
T 170 × RRIC 52	1011*, 1019, 1024*.
T 180 × Tjir 1	1032*
T 713 × Tjir 1	1047*, 1048*, 1049*.
T 16 × Tjir 1	1050*, (1051), 1053.
T 170 × Tjir 1	1054, 1056, 1057, 1059, 1060, 1061, 1063, 1064.
T 792 × Tjir 1	1066.
T 792 × RRIC 52	(1067).
Tjir 1 × Wagga 6278	(1069), 1070*.
Wag 6278 × Tjir 1	1073, 1074.
	1959 Progeny
RRIC 52 × RRIC 7	1101*, 1102, 1105*, (1109), 1111, 1113, 1114, (1115), (1117).
T 306 × PB 86	1122*, 1123*, (1128).
LCB 1320 × RRIC 45	1131, (1132), 1133, 1134, (1136), 1138, 1140*, 1141, 1142*.
RRIC 45 × RRIC 13	1144, (1145), 1146, 1147*, 1148, 1149*, 1150, 1151*, 1152*.
RRIC 86 × T 108	1155.
RRIC 74 × Ch 26	1156, (1157), 1158*.
RRIC 86 × RRIC 7	1159*, 1162, 1163*.
Ch 26 × RRIC 7	1167*, 1168, 1169*, 1171, 1172*, 1173, 1174, 1175*, (1176), 1177*, 1178*, 1179, 1180, (1181).
Ch 26 × T 108	1186, (1187), 1188, 1190, (1191), (1195), (1196), (1201).
RRIC 86 × RRIC 52	1204, 1205*, 1206, 1207, (1208), 1209*, 1210, 1212*, 1213, 1215, 1216.
Ch 26 × RRIC 36	1219, (1222), (1223), 1224, (1225).
LCB 870 × RRIC 7	1229, 1230.
T 713 × RRIC 86	1232, 1233, 1234.
LCB 1320 × T 327	1237, (1242).
Ch 26 × RRIC 52	1244, (1245), 1246, (1247), (1248), (1249), (1250), (1251), (1253), 1254, 1256*, (1257), 1258, 1259, 1265, (1266), 1272, 1275, 1276, (1279), 1282, 1283, (1284), 1285, (1286), 1287*, 1288*.
RRIC 52 × RRIC 86	1289, 1290*, 1291*.
RRIC 51 × RRIC 45	1292*, 1293*, 1294*.
RRIC 86 × RRIC 52	1295*, 1296, 1298, 1301*,
RRIC 41 × Ch 26	(1303), 1304*, 1305*, 1306.
T 306 × RRIC 52	1310, (1313).
RRIC 45 × LCB 1320	1315, 1316, 1317.
PB 86 × RRIC 86	1321, 1322, (1324).
T 16 × RRIC 52	(1326).
PB 86 × RRIC 36	(1327), 1329.
RRIC 52 × PB 86	(1331), 1333, 1336*.
T 327 × Nab 20	1341, 1342*, (1343), (1345), 1346, 1347, 1351, 1352, 1353*, 1354*.
RRIC 45 × RRIC 51	1356*, 1360*, 1361*.
PB 86 × RRIC 7	(1367), 1368, (1369), 1370, (1371), (1372), 1380, (1381), (1383), (1384), (1386), 1387.
T 16 × PB 86	1393, (1395), (1398), 1399.

Other clones successfully planted during the 1961 South-West monsoon season at Kuruwita Sub-station were:—

IRCI (1), 2, 3, (9).
TR (1406), (1486), (1512), (1514), 1542, (1573), (3633), (3645).
PR 226, 228*, 231, (248), 249*, 250*, 251*, 252*, 253*, 254, 255*, 256*, 257, (258), 259*, 260*.
(WR 101)
(GT 1).

The control clone used was PB 86.

North-East monsoon planting

Certain legitimate seedling progeny which did not peel during the earlier trial were "cloned" for the remaining 15-acre planting at Kuruwita. Many foreign clones which were not budgrafted successfully for the earlier planting are represented in this trial. Most of the material was planted as ten-tree clones but where sufficient buddings were not available five-tree clones were planted. Certain clones which merited larger scale trial were planted as thirty-tree blocks either as a single block or with replications. The composition of the planting was as follows:—

( ) five-point planting

1956 Progeny

Family	Clone Nos.
RRIC 8 × RRIC 50	67, 68.
RRIC 8 × RRIC 8	75.
RRIC 41 × (PB 86 × AVROS 157)	77, 78, 79, 80.
RRIC 41 × RRIC 10	83, 85, 86, 89, 91.
RRIC 45 × (PB 86 × Mil 3/2)	98, 99, 100.

1959 Progeny

RRIC 52 × T 792	1459, 1460, 1461.
Nab 20 × RRIC 7	1462, 1463, 1464, 1466, 1468, 1469, 1470, 1472, 1473, 1475, 1476, 1477, 1479, 1480, 1481, 1482, 1484, 1485, 1486, 1487, 1488, 1489, 1490, 1491, 1492, 1494, 1496, 1497, 1498.

1960 Progeny

RRIC 45 × GPM 1	1502, 1529, 1532, 1533, 1559, 1575, 1579, 1591, 1592, 1606.
RRIC 51 × Wagga 6278	1615, 1616, 1618.
RRIC 45 × PR 107	1793, 1794, 1795, 1796, 1798, 1799, 1805, 1812, 1813, 1819.
RRIC 45 × LCB 1320	1829, 1835, 1842, 1851, 1857, 1861, 1867.
RRIC 51 × LCB 1320	1877, 1881, 1887, 1895, 1900, 1922, 1923, 1927.
RRIC 52 × RRIC 7	2009, 2010, 2012, 2018, 2019, 2024, 2027, 2040, 2043, 2051.
RRIC 52 × Wagga 6278	2105, 2106, 2128.
RRIM 513 × RRIC 52	2129, 2130, 2131.
RRIC 52 × T 170	2154.
RRIC 52 × T 290	2181, 2182, 2186, 2196, 2198.
RRIC 52 × LCB 1320	2264.
RRIC 52 × RRIC 36	2274.
RRIC 52 × AVROS 157	2301, 2302, 2306, 2307, 2308, 2310, 2311, 2313, 2315, 2316.
RRIC 52 × H 151	2319, 2323, 2335, 2338, 2353.

Dothidella-Resistant Selections

FX	590, (614), 649, (637), 2261, 3810.
IAN	2321, (2322), 2328, 2361, 2363, 2489, (2491), 2570, (2664), 2668, 2750, 2829, 2833, (2867), 2877, 2878, 2879, (2887), 2890, (2891), (2892), (2897), 2900, 2903, (2904), 2920, (2921), 2923, 2928, (2954), 2958, (2960), (2965), (3434), (3457), (3646), 3702, 3711, 3714, (3787), 3793, 3795, (3803), 3827, (3828), (6163), 6165, (6166), (6167), (6497), 6499, 6500, 6584, 6585, 6586, 6587, 6640, 6641, 6645, 6753, (6755), (6756), (6757), 6834.
	45–710, (45–873).

Family	1960 Progeny
	Other Introductions to Ceylon
C	695
ST	71
GT	127
RRIM	513, (601), 602, 604, 608, 610, 611, 612, (617), (618), (620), 628, 701.
TR	1548, 1555, (1560), (3702), 3705.
IRCI	(5), (6), 7, (8), (9), 10.
PR	(247).
AVROS	529, (1060), (1191), 1349, 1502, (1518), 1591, 1712, (1735), (1851), (1907), (2037).
RRIM–ES Series	2, 3, 4, 5, 6, 8, 9.
	Other local clones
Nab	(15)
RRIC	14, (15), (41), (86)

Material planted on a larger scale

20 plants: AVROS 427.
30 plants each: Harbel 1, RRIM 605, AVROS 308, AVROS 385.
4 replications of 30 plants each of PB 86, RRIC 52, RRIC 88, RRIC 89.
5 replications of 30 plants each of PB 28/59.
190 border plants of clone PB 86.

4. FLOWER INDUCEMENT

4.1. Pollarded area, Nivitigalakele. General care and maintenance of this area continues. Labelling has been renewed for clearer marking. The object of concentrating breeding material at Nivitigalakele is being gradually implemented. A reference list of the original tree numbers and the successfully budded clones is given in Table II.

TABLE II

Reference List—Pollarded Area—Nivitigalakele

Tree No.	Clone	Tree No.	Clone	Tree No.	Clone
10	PB 86	76	IAN 3434	122	PR 261
11	PB 86	82	IAN 6584	123	RRIC 86
12	PB 86	83	RRIC 36	124	LCB 1320
13	FX 2925	84	IRCI 10	125	PR 226
14	FX 637	86	RRIC 50	126	RRIC 10
29	IAN 45–717	87	IAN 6155	127	IAN 6640
30	IAN 45–873	88	RRIC 45	128	IAN 6754
31	IAN 2668	89	IAN 2965	129	IAN 6166
33	IAN 2829	90	PB 86	130	RRIC 76
34	IAN 3763	91	IAN 3711	131	IAN 6500
35	IAN 2954	92	IAN 3711	132	BD 10
36	Harbel 1	93	IAN 2891	133	C 695
37	IAN 2954	94	IAN 3795	134	IAN 6640
38	IAN 2664	95	IAN 2920	135	GT 127
39	IAN 2667	96	IAN 2958	137	IAN 3819
40	IAN 2667	97	IAN 6166	138	IAN 3763
42	IAN 45–717	98	IAN 6497	139	IAN 2958
46	IAN 2960	99	IAN 6641	140	ST 71
47	IAN 3646	100	IAN 6754	141	Harbel 1
48	FX 3810	101	IAN 6500	143	FX 516
49	FX 3810	102	IAN 6587	144	RRIC 52
65	IAN 45–717	104	RRIC 45	145	PR 261
66	IAN 45–717	108	IAN 6587	146	IAN 6584
67	IAN 3714	111	IAN 6641	147	RRIC 85
68	IAN 45–717	112	LCB 1320	148	IAN 6165
69	IAN 3787	113	RRIC 52	149	AVROS 157
71	IAN 3793	114	RRIC 69	150	RRIC 15
72	ST 71	116	RRIC 50	151	RRIC 69
73	IAN 3714	117	IAN 6497	152	FX 516
74	IAN 3702	120	IRCI 10	154	PR 226
75	IAN 3434	121	AVROS 157		

4.2. Flower Stimulation. Of the nursery plants ringed in 1960 the following clones flowered according to plan and were used in the 1961 hand-pollination programme:

F 4542
FB 3300
FX 349, 4098
IAN 2833
IAN 45–710, 45–873
RRIC 10, 36, 51

Owing to the small number of flowers obtained it was not possible to carry out a sufficiently large number of hand pollinations to ensure a full *Dothidella*-resistance breeding programme but sufficient material was made available to justify this method on a larger scale.

A number of selected RRIC clones and *Dothidella*-resistant clones were ringed in September in order to expand the 1962 hand-pollination programme.

5. EXPERIMENTS ON COMMERCIAL ESTATES

5.1. Oidium Testing Station, Kepitigalla Group

The 1959 area which had been released from fungicidal control towards the end of 1960 was screened for *Oidium* resistance and the results are shown in Table III. Of the material screened clone F 4542 justified its original promise of *Oidium* resistance; of the other *Dothidella*-resistant introductions that were planted the following clones showed sufficient promise of *Oidium* resistance for incorporation in breeding programmes:

FX 590
FX 614
FX 2261
IAN 45–710
IAN 45–717
IAN 3793
IAN 3828
FX 637
FX 3810

The next most important breeding guide line obtained was the capacity of clone RRIC 52 to intensify *Oidium* resistance in material such as LCB 870 crosses which would normally, on outcrosses, give an attenuated degree of *Oidium* resistance. The test of RRIC 52 itself was valuable in showing the satisfactory growth of this clone under conditions of *Oidium* infection. The control clone Tjir 1 was invariably very badly infected, and many buddings of the clone have succumbed to the disease. Some Tjir 1 plants amongst the resistant clones show better leaf and growth than the other Tjir 1 plants.

5.1.1. A census was taken of the 1960 planting and 266 vacancies noted many of which were the Tjir 1 control plants. As no clone had lost all points no vacancies were supplied.

5.2. Hevea Breeding Station, Nakkala Estate, Moneragala

The growth of the original budgrafts made at this Station has been noted to be very satisfactory and owing to the vigorous nature of most of these clones they are gradually outstripping the unbudded trees. The planting of material top budded at Nivitigalakele and transported to Moneragala could not be described as

commercially feasible owing to the heavy (50% to date) mortality experienced but experimentally this operation served to fill in needed vacancies in plots where establishment by budgrafting had not been successful. The present status of the Station is shown in Table IV.

Of the initial budgrafts made in January and February 1960 clones RRIM 513 and IAN 2892 have not yet been established. Of the late 1960 budgrafts clones IAN 2744, IAN 6167, RRIC 15, RRIC 45, RRIC 52, and AVROS 2037 have not yet been established.

TABLE III

Screening of Oidium Test area at Kepitigalla Group

Key: I. *Oidium* Resistance obvious
II. ,, ,, possible
III. ,, ,, doubtful
IV. ,, ,, absent

Clone	Origin and/or Parentage	*Oidium* Resistance Rating	Remarks
	Dothidella-resistant introduction in 1955		
F 4542	*H. benthamiana selection of Rio Negro Origin*	I	
	Dothidella-resistant introductions in 1957.		
FX 349	F 4542 × Tjir 1	III	
,, 505	F 4542 × AV 363	IV	
,, 567	,, × ,,	III	
,, 590	,, × ,,	II	Attacked by *Gloeosporium*.
,, 614	F 4542 × Tjir 1	II	
,, 1042	F 4542 × PB 186	IV	
,, 2261	F 1619 × AV 183	II	
,, 3482	F 4542 × PB 86	IV	
,, 3899	F 4542 × AV 363	IV	
,, 4098	PB 86 × B 74	IV	
IAN 45–710	PB 86 × F 409	II	
,, 45–713	,, × ,,	IV	
,, 45–717	PB 86 × F 4542	II	
,, 45–873	PB 86 × FA 1717	IV	
,, 2664	FX 4068 (F 4542 × PB 86) × PB 86	IV	
,, 2867	FX 516 (F 4542 × AV 363) × PB 86	III	
,, 2877	,, × ,,	IV	
,, 2887	,, × ,,	IV	
,, 2890	FX 2831 (F 4542 × Tjir 1) × ,,	IV	
,, 2892	,, × ,,	IV	
,, 2903	FX 516 (F 4542 × AV 363) × ,,	IV	
,, 2904	,, × ,,	IV	
,, 2923	,, × ,,	IV	
,, 2928	,, × ,,	III	
,, 3434	FX 4371 (F 4542 × PB 86) × ,,	IV	
,, 3457	Tjir 1 × FX 652 (F 4542 × Tjir 1)	IV	
,, 3460	,, × ,,	IV	
,, 3646	FX 516 (F 4542 × AV 363) × Tjir 1	III	
,, 3702	FX 4371 (F 4542 × PB 86) × PB 86	IV	
,, 3711	,, × ,,	IV	
,, 3714	,, × ,,	IV	
,, 3763	,, × ,,	IV	
,, 3787	FX 516 (F 4542 × AV 363) × Tjir 1	IV	
,, 3793	,, × ,,	II	
,, 3795	,, × ,,	IV	
,, 3803	FX 567 (F 4542 × AV 363) × PB 86	IV	
,, 3819	FX 617 (F 4542 × Tjir 1) × Tjir 1	IV	
,, 3827	FX 516 (F 4542 × AV 363) × AV 363	III	
,, 3828	,, × ,,	II	
,, 3892	FX 617 (F 4542 × Tjir) × Tjir 1	IV	
,, 3893	,, × ,,	IV	

TABLE III—(*Contd.*)

Clone	Origin and/or Parentage	*Oidium* Resistance Rating	Remarks
	Dothidella-resistant introductions in 1958/59:		
FX 637	F 4542 × Tjir 1	II	
,, 3810	F 4542 × AV 363	II	
,, 3925	,, × ,,	III	
,, 4065	F 4542 × PB 86	IV	
IAN 2489	FX 4068 (F 4542 × PB 86) × Tjir 1	IV	
,, 2491	,, × ,,	IV	
,, 2570	,, × ,,	IV	
,, 2667	FX 4068 (F 4542 × PB 86) × PB 86	IV	
,, 2668	,, × ,,	IV	
,, 2744	FX 4068 (F 4542 × PB 86) × Tjir 1	IV	
,, 2750	,, × ,,	IV	
,, 2829	FX 516 (F 4542 × AV 363) × PB 86	IV	
,, 2833	,, × ,,	IV	
,, 2878	,, × ,,	III	
,, 2879	,, × ,,	IV	
,, 2891	FX 2831 (F 4542 × Tjir 1) × ,,	IV	
,, 2897	,, × ,,	IV	
,, 2920	FX 516 (F 4542 × AV 363) × PB 86	IV	
,, 2921	,, × ,,	IV	
,, 2954	FX 4073 (F 4542 × PB 86) × PB 86	IV	
,, 2958	,, × ,,	IV	
,, 2960	,, × ,,	IV	
,, 2965	,, × ,,	IV	
	From 1952 Clearing, Dartonfield.		
T 16	LCB 870 × PB 86	II	
T 108	,, × ,,	II	Replicates inconsistent
T 170	,, × ,,	II	
T 290	,, × ,,	I	
T 304	,, × ,,	III	
T 180	,, × ,,	I	
T 698	,, × ,,	III	
T 792	,, × ,,	III	Replicates inconsistent
	From 5 pt. buddings 1955 Clearing, Hedigalla.		
H 149	BR 2 × LCB 870	III	
H 150	LCB 870 × PB 86	II	
H 151	,, × ,,	II	
H 163	LCB 870 × RRIC 8	II	
H 167	LCB 870 × BD 10	II	
H 170	RRIC 36 (PB 86 × PR 107) × LCB 870	III	
H 171	,, × ,,	II	
H 174	RRIC 38 (PB 86 × PR 107) × LCB 870	II	
H 180	RRIC 52 × LCB 870	II	
H 181	,, × ,,	I	
	From 1953 Hand-pollinated seedlings, 1955 Clearing, Hedigalla.		
H 199	LCB 870 × Mil 3/2	IV	
H 236	,, × ,,	III	
H 239	,, × ,,	II	
H 243	,, × ,,	III	
H 275	,, × ,,	III	Replicates inconsistent

TABLE III—*(Contd.)*

Clone	Origin and/or Parentage	*Oidium* Resistance Rating	Remarks
	From 1953 hand-pollinated seedlings, 1955 clearing, Hedigalla.		
H 277	LCB 870 × Mil 3/2	II	
H 300	,, × ,,	II	
H 319	,, × ,,	III	Replicates inconsistent
H 344	,, × ,,	III	
H 355	,, × ,,	II	
H 371	LCB 870 × BR 2	II	
H 385	,, × ,,	III	Replicates inconsistent
H 387	,, × ,,	III	Attacked by *Gloeosporium*
H 392	,, × ,,	IV	
H 395	,, × ,,	IV	
H 397	,, × ,,	III	
H 398	,, × ,,	I	
H 1021	,, × ,,	IV	Attacked by *Gloeosporium*
H 1022	,, × ,,	IV	,,
H 404	,, × Wagga 6278	IV	
H 405	,, × ,,	IV	
H 406	,, × ,,	III	
H 408	,, × ,,	III	
H 410	,, × ,,	IV	
H 412	,, × ,,	IV	
H 416	,, × ,,	II	
H 417	,, × ,,	IV	
H 421	,, × ,,	I	
H 422	,, × ,,	III	
H 423	,, × ,,	IV	
H 424	,, × ,,	III	Replicates inconsistent
H 428	,, × ,,	II	
H 429	,, × ,,	I	
H 434	,, × ,,	III	Replicates inconsistent
H 436	,, × ,,	III	
H 439	,, × ,,	II	
H 440	,, × ,,	II	
H 443	,, × ,,	IV	
H 444	,, × ,,	III	
H 446	,, × ,,	III	
H 447	,, × ,,	III	
H 448	,, × ,,	III	
H 450	,, × ,,	II	
H 451	,, × ,,	III	
H 452	,, × ,,	II	
H 454	,, × ,,	II	
H 455	,, × ,,	II	
H 456	,, × ,,	II	
H 457	,, × ,,	II	
H 459	,, × ,,	IV	
H 464	,, × ,,	IV	
H 466	,, × ,,	IV	
H 469	,, × ,,	IV	
H 470	,, × ,,	III	Replicates inconsistent
H 471	,, × ,,	III	,, ,,
H 507	LCB 870 × PB 23	II	
H 521	,, × ,,	II	
H 556	,, × ,,	II	
H 594	,, × ,,	III	

TABLE III—(*Contd.*)

Clone	Origin and/or Parentage	*Oidium* Resistance Rating	Remarks
	From 1953 hand-pollinated seedlings, 1955 clearing, Hedigalla		
H 624	LCB 870 × RRIC 8	III	Replicates inconsistent
H 645	,, × ,,	II	
H 697	,, × ,,	II	
H 700	,, × ,,	II	Replicates inconsistent
H 776	LCB 870 × Glen 1	I	
H 788	,, × ,,	II	
H 817	,, × ,,	II	
H 822	,, × ,,	II	
H 1000	,, × ,,	II	
H 827	LCB 870 × BD 10	II	Attacked by *Gloeosporium*
H 828	,, × ,,	II	Vigorous
H 829	,, × ,,	II	
H 833	,, × ,,	III	
H 835	,, × ,,	III	
H 839	,, × ,,	III	
H 848	,, × ,,	II	
H 849	,, × ,,	IV	
H 853	,, × ,,	IV	
H 854	,, × ,,	IV	
H 856	,, × ,,	IV	
H 860	,, × ,,	II	
H 862	,, × ,,	II	
H 864	,, × ,,	IV	
H 865	,, × ,,	IV	
H 871	,, × ,,	IV	
H 879	,, × ,,	III	Replicates inconsistent
H 890	LCB 870 × PB 86	III	
H 893	,, × ,,	II	
H 900	,, × ,,	II	Attacked by *Gloeosporium*
H 902	,, × ,,	III	
H 905	,, × ,,	IV	
H 913	,, × ,,	I	
H 914	,, × ,,	II	Attacked by *Phytophthora*
H 918	,, × ,,	III	
H 923	,, × ,,	III	
H 925	,, × ,,	II	
H 928	,, × ,,	II	
H 930	,, × ,,	III	
H 946	LCB 870 × RRIC 37 (RRIC 8 × DBK 1)	II	
H 947	,, × ,,	II	
	Nursery selections, 1957 hand-pollinations		
881	PB 5/139 × RRIC 52	IV	
874	,, × ,,	IV	
824	,, × ,,	IV	
788	,, × ,,	IV	
785	,, × ,,	IV	
686	PB 86 × RRIC 52	IV	
690	,, × ,,	IV	
764	RRIC 52 × Tjir 1	IV	
777	,, × ,,	III	
778	,, × ,,	III	
431	RRIC 52 × PB 86	II	Vigorous
444	,, × ,,	II	
480	,, × ,,	III	
507	,, × ,,	IV	
274	RRIC 52 × PB 5/139	IV	Attacked by *Gloeosporium*
276	,, × ,,	IV	

TABLE III—(*Contd.*)

Clone	Origin and/or Parentage	*Oidium* Resistance Rating	Remarks
	Nursery selections, 1958 hand-pollinations		
979	PB 86 × T 792 (LCB 870 × PB 86)	III	Replicates inconsistent
984	,, × ,,	IV	
986	,, × ,,	IV	
1004	T 170 (LCB 870 × PB 86) × RRIC 52	II	Vigorous
1005	,, × ,,	III	
1010	,, × ,,	I	Vigorous
1011	,, × ,,	III	
1015	,, × ,,	IV	
1019	,, × ,,	III	
1020	,, × ,,	I	Vigorous
1024	,, × ,,	III	
1029	T 713 (LCB 870 × PB 86) × RRIC 52	IV	
1031	,, × ,,	III	Vigorous
1032	T 180 (LCB 870 × PB 86) × Tjir 1	IV	
1033	,, × ,,	IV	
1037	,, × ,,	IV	
1039	,, × ,,	IV	Vigorous
1042	,, × ,,	III	Vigorous
915	PB 86 × T 306 (LCB 870 × PB 86)	III	
925	,, × ,,	III	
932	,, × ,,	III	
934	,, × ,,	III	
1045	T 713 (LCB 870 × PB 86) × Tjir 1	III	
1046	,, × ,,	IV	
1047	,, × ,,	IV	
1048	,, × ,,	IV	
1050	T 16 (LCB 870 × PB 86) × ,,	IV	
1051	,, × ,,	IV	
1053	,, × ,,	IV	
1059	T 170 (LCB 870 × PB 86) × ,,	IV	
1063	,, × ,,	IV	
1064	,, × ,,	IV	
1066	T 792 (LCB 870 × PB 86) × ,,	III	
1067	T 792 (LCB 870 × PB 86) × RRIC 52	IV	
	Established clones		
GPM 1	From Galapitamada Estate, Kegalle	III	Replicates inconsistent
LCB 1320		IV	
PB 86		IV	
RRIC 52		II	
	Control		
Tjir 1		IV	

TABLE IV

Hevea Breeding Station at Nakkala Estate, Moneragala

(Recurring clones are those planted in more than one position)

* live bud or very young shoot

Clone	No. of successful shoots	Clone	No. of successful shoots	Clone	No. of successful shoots	Clone	No. of successful shoots
C 695	2	IAN 2570	3	IAN 3893	5	IAN 6757	2,8*
TR 1548	3	IAN 2833	1	IAN 3460	1	IAN 6834	1
LCB 1320	3	FX 637	7	IRCI 7	2	AVROS 157	1*
PB 86	1	IAN 2877	4	GT 1	4	BD 10	2,3*
OY 1	2	IAN 2878	4	RRIM 605	1	RRIC 10	1,5*
GT 1	1*	IAN 2879	1	IAN 45–710	6	RRIC 15	—
Nab 15	2	IAN 2890	2	IAN 45–713	7	F 4542	1*
WR 101	4	IAN 2891	2	IAN 45–717	1	IAN 45–717	1,2*
PB 86	1	IAN 2892	—	IAN 45–873	1	RRIC 45	—
C 695	2	IAN 2920	3	IAN 2321	4*	RRIC 51	1,2*
Harbel 1	2	IAN 2923	1	IAN 2744	—	RRIC 52	—
Wagga 6278	2	FX 2261	3	F 4542	—	IRCI 10	3,3*
PB 86	2	IAN 2928	5	FX 516	2*	AVROS 385	5,6*
RRIM 513	—	IAN 2954	2	IAN 3646	4*	AVROS 2037	—
RRIM 603	2	IAN 2958	2	IAN 6163	4*	IAN 2322	3*
RRIM 605	2	IAN 2960	1	IAN 6165	4*	IAN 2328	1*
RRIM 623	2	IAN 2965	2	IAN 6166	2*	IAN 2361	2*
IRCI 7	—	IAN 3434	4	IAN 6167	—		
PR 228	2	IAN 3457	3	IAN 6497	3,3*		
Tjir 1	3	IAN 3810	7	IAN 6499	2*		
RRIC 7	4	IAN 3646	3	IAN 6500	1,3*		
RRIC 36	2	IAN 3702	3	IAN 6584	1*		
RRIC 45	1	IAN 3711	1	IAN 6585	2,3*		
RRIC 51	5	IAN 3714	1	IAN 6586	4*		
RRIC 52	4	IAN 3763	2	IAN 6587	2,6*		
RRIC 86	2	IAN 3795	2	IAN 6640	3,3*		
AVROS 385	3	IAN 3803	1	IAN 6641	3*		
AVROS 2037	3	IAN 3819	1	IAN 6645	3,5*		
FX 516	7	IAN 3827	1	IAN 6753	2*		
IAN 2489	6	FX 3925	5	IAN 6754	3,6*		
IAN 2491	4	IAN 3828	4	IAN 6755	1,1*		
IAN 2570	3	IAN 3892	1	IAN 6756	3*		
IAN 2664	1*						
IAN 2667	1*						
IAN 2668	4						

5.3. Supplementary Plant Breeding Station at Kumarawatte Group, Moneragala

A Clone Trial *cum* Plant Breeding Station was established on Kumarawatte Group in order to maintain the highest possible breeding potential for the Station already established at Moneragalla Group and to give some idea of the parallel yield and development of secondary characters in a district different to that of routine trial.

The following material was established as 2-tree clones in this planting.

1956 Progeny Selections

Family	Clone Nos.
RRIC 8 × PR 107	4
RRIC 8 × (PB 86 × AVROS 157)	17
AVROS 157 × RRIM 501	29, 33, 35.
AVROS 157 × RRIC 8	54
RRIC 8 × RRIC 50	67, 68.
RRIC 41 × (PB 86 × AVROS 157)	75, 79, 80, 81.
RRIC 41 × RRIC 10	82, 83, 84, 85, 86, 89.
RRIC 45 × (PB 86 × Mil 3/2)	99
RRIC 8 × (TKD 113 × Tjir 1)	104
RRIC 8 × (PB 86 × RRIM 519)	106

1957 Progeny Selections

Mil 3/2 × Tjir 1	258, 266.
RRIC 52 × PB 5/139	275
Tjir 1 × RRIC 50	292, 297, 302, 346, 350, 359, 363, 378, 383, 396.
RRIC 52 × PB 86	447, 455, 465, 484, 485, 489, 500, 508, 511, 516, 525, 528, 532, 534, 539, 544, 569, 570, 592, 603, 609, 615, 642, 643,
PB 86 × RRIC 52	686, 688.
RRIC 52 × Tjir 1	732, 734, 743, 778, 780.
PB 5/139 × RRIC 52	788, 794, 804, 819, 820, 822, 827, 835, 843, 845, 854, 863, 865, 868, 872, 875, 887.

1958 Progeny Selections

T 170 × RRIC 52	1011, 1019, 1024.
T 792 × Tjir 1	1066.
Tjir 1 × Wagga 6278	1068, 1071.
Wagga 6278 × Tjir 1	1073.

1959 Progeny Selections

RRIC 52 × RRIC 7	1114, 1117.
LCB 1320 × RRIC 45	1137
RRIC 45 × RRIC 13	1145, 1148, 1152.
Ch 26 × RRIC 7	1171, 1172, 1174.
Ch 26 × T 108	1204
RRIC 86 × RRIC 52	1205, 1207.
Ch 26 × RRIC 36	1218, 1221.
Ch 26 × RRIC 52	1247, 1249, 1252, 1255, 1257, 1258, 1259, 1268, 1272, 1275, 1276, 1278, 1284, 1286.
RRIC 52 × RRIC 86	1289.
RRIC 86 × RRIC 52	1298
RRIC 41 × Ch 26	1304, 1306, 1307.
T 306 × RRIC 52	1310, 1313.
RRIC 45 × LCB 1320	1316, 1317.
RRIC 52 × PB 86	1331
RRIC 52 × T 792	1459, 1460, 1461.
Nab 20 × RRIC 7	1463, 1464, 1468, 1472, 1473, 1476, 1477, 1480, 1482, 1484, 1485, 1486, 1487, 1488, 1491, 1492, 1494, 1496.

1960 Progeny Selections

RRIC 45 × GPM 1	1502, 1532, 1579, 1591, 1592, 1606,
RRIC 51 × Wagga 6278	1615, 1616, 1618.
RRIC 45 × PR 107	1793, 1795, 1796, 1798, 1799, 1805, 1812, 1813, 1819.
RRIC 45 × LCB 1320	1829, 1842, 1854, 1857, 1861, 1867.
RRIC 51 × LCB 1320	1886, 1887, 1895, 1923, 1927.
RRIC 52 × RRIC 7	2009, 2010, 2012, 2018, 2019, 2024, 2027, 2040, 2043, 2051.
RRIC 52 × Wagga 6278	2116, 2128.
RRIM 513 × RRIC 52	2129, 2130, 2131.
RRIC 52 × T 290	2181, 2182, 2186, 2196.
RRIC 52 × LCB 1320	2264
RRIC 52 × RRIC 36	2274
RRIC 52 × AVROS 157	2301, 2302, 2306, 2307, 2308, 2310, 2311, 2315, 2316.
RRIC 52 × H 151	2319, 2323, 2335, 2353.

Established clones	RRIC 10, RRIC 14, RRIC 15.	
Distributed clones	PB 28/59	60 plants
	RRIC 7	30 ,,
	RRIC 52	60 ,,
	RRIC 88	60 ,,
	RRIC 89	30 ,,

5.4. Phytophthora Testing Station, Peenkande Group

The plants in this experimental area are growing well. The area is estimated to be ready for detailed screening in 1962 or after. A census taken in May showed 69 dead plants but no clone was completely eliminated. The side shoots of the plants were pruned in accordance with estate practice.

Under the conditions of exposure to *Phytophthora* attack without protection a few cases of infection of the green shoot were observed. This sort of attack is usually restricted to nursery plants under dense planting conditions and is not a feature of mature plantings. Although the object of this experiment is to evaluate mature leaf susceptibility, the clones showing green shoot damage are listed below for purposes of record. These clones are as follows:—

Dothidella-Resistant Material

Clone	Origin and/or Parentage
F 409	*H. brasiliensis* selection
F 4537	*H. benthamiana* selection
F 4542	*H. benthamiana* selection
FX 3482	F 4542 × PB 86
FX 3925	F 4542 × AV 363
IAN 2322	PB 86 × FX 3993 (F 4542 × AV 363)
IAN 2363	PB 86 × FX 4371 (F 4542 × PB 86)
IAN 2744	FX 4068 (F 4542 × PB 86) × Tjir 1
IAN 2879	FX 516 (F 4542 × AV 363) × PB 86
IAN 2887	,, × ,,
IAN 2892	FX 2831 (F 4542 × Tjir 1) × PB 86
IAN 2897	,, × ,,
IAN 2900	FX 516 (F 4542 × AV 363) × PB 86
IAN 3702	FX 4371 (F 4542 × PB 86) × PB 86
IAN 3711	,, × ,,
IAN 3763	,, × ,,
IAN 3819	FX 617 (F 4542 × Tjir 1) × Tjir 1
IAN 3893	FX 617 ,, ,, × ,,
IAN 6165	FX 43–448 (PB 86 × FX 2251 (F 4542 × AV 183)) × Tjir 1
IAN 6584	FX 43–651 (FX 213 (F 4542 × AV 183) × AV 183)) × PB 86
IAN 6586	FX 43–651 (FX 213 (F 4542 × AV 183) × AV 183)) × PB86
IAN 6641	FX 43–655 (FX 213 (F 4542 × AV 183) × AV 183)) × PB 86
IAN 6645	FX 43–655 (FX 213 (F 4542 × AV 183) × AV 183)) × PB 86
IAN 6834	FX 43–443 (PB 86 × FX 2251 (F 4542 × AV 183)) × AV 49 (false)

Local Clones

RRIC 52	Selected seedling origin
109	BD 10 × PR 107
788	PB 5/139 × RRIC 52
885	,, × ,,
1007	T 170 × RRIC 52
1023	,, × ,,
1136	LCB 1320 × RRIC 45
1239	LCB 1320 × T 327
1242	,, × ,,

Two plants of the control clone PB 86 also showed this type of die-back.

REVIEW OF THE PLANT PATHOLOGY DEPARTMENT

By

O. S. Peries

SUMMARY

The Plant Pathologist, Dr. A. Riggenbach, resigned his appointment on completion of his period of contract and left the Island on 4th August 1961. The Assistant Plant Pathologist, Dr. O. S. Peries, returned to the Island on 23rd December 1961, after successfully completing his post-graduate studies at the University of Bristol.

The incidence of *Oidium* leaf disease remained relatively light throughout the rubber growing districts of Ceylon, the weather conditions generally being non-conducive to the development of the disease during the refoliation season of 1961.

The Plant Pathology Department conducted five field experiments during the *Oidium* season. The aim of these experiments, distributed over four estates and covering a total area of 118 acres, was to compare the effectiveness of dusting with that of spraying.

The results of these experiments, which confirm those of the previous year, show that under certain conditions better control of the disease can be achieved by spraying than by dusting with sulphur fungicides.

Some of the *Oidium* control experiments were designed to test the feasibility of achieving an indirect control of *Phytophthora* leaf disease later in the year by reducing fruit set. Different chemicals which induce flower fall were applied together with wettable sulphur used for the control of *Oidium* in these experiments. The results of the experiments this year indicate that the desired objective cannot be achieved with any of the chemicals tested under these experimental conditions.

The incidence of *Phytophthora* leaf disease was relatively low during the early part of the South West monsoon season, but some estates recorded fairly heavy leaf fall caused by this disease in late August and September as a result of the abnormally wet conditions that prevailed during the tail end of the monsoon.

Nine field experiments, distributed over four estates and covering a total area of 317 acres, were carried out during the *Phytophthora* season, in order to compare spraying with dusting as a method of control and to test different fungicidal preparations formulated either as dusts or as water-based or oil-based sprays.

The results of these field experiments were rather disappointing due to the low, and in some cases negligible, incidence of *Phytophthora* leaf disease in the experimental areas. A water suspension of copper oxychloride (57% at 2 lb per acre per round) to which is added a new low volume formulation has given the best results.

The incidence of Black Stripe disease, caused by the fungus *Phytophthora palmivora*, remained low during the major part of the South West monsoon season but, like leaf-fall caused by the same fungus, some estates reported heavy attacks of Black Stripe during the later stages of the monsoon.

Laboratory studies were carried out on certain aspects of the biology of the fungus *Phytophthora palmivora*, with a view to establishing the type of microclimatic conditions which are conducive to the propagation of this fungus. An analysis of bark samples from various clones, both susceptible and resistant to Black Stripe, was also undertaken in order to find out whether there is any correlation between the anatomical structure and chemical composition of the bark of different clones and their susceptibility to this disease.

Gloeosporium leaf disease, which was more prevalent in 1960 than in previous years, was again a source of some concern in certain estates during the wetter periods of the year.

Laboratory studies on *Fomes lignosus* were continued, and a number of new fungicides were tested for the control of this disease. Organo-mercurial fungicides again proved the most promising of the materials tested, and these have given good results in field trials.

DETAILED REVIEW

1. GENERAL

1.1. Staff.—The Plant Pathologist, Dr. A Riggenbach, resigned his appointment on the termination of his contract. He left the Island on 4th August 1961.

The Assistant Plant Pathologist, Dr. O. S. Peries, returned to the Island on 23 December 1961, after completing his post-graduate studies leading to the degree of Doctor of Philosophy of the University of Bristol. He assumed duties as Acting Plant Pathologist on the 27 December 1961.

The Research Assistant, Miss V. Sivapalan, completed her two-year period of probation and was confirmed in her appointment in November 1961. Miss Sivapalan was on duty throughout the year.

The Senior Technical Assistant, Mr. H. L. Munasinghe, and the Technical Assistants, Messrs. E. G. Mendis, M. Fernando, S. K. Samaraweera, D. M. Dantanarayana and W. C. Dayaratne, were on duty throughout the year.

Messrs. E. G. Mendis and W. C. Dayaratne have worked full time with the newly appointed Agricultural Engineer, since the beginning of November.

1.2. Correspondence

		Inward	Outward
General	...	79	137
Technical	...	466	408

1.3. Visits

Advisory	...	56
Experimental work	...	61

Following every advisory visit a full report, giving our observations and recommendations, was sent to the estates concerned.

The Plant Pathologist visited South India in early May to observe and report on the large-scale aerial spraying experiments carried out by certain commercial firms on some rubber estates in the Mundakayam and Trichur areas of Kerala State.

The Plant Pathologist addressed one meeting of the Kelani Valley and two meetings of the Kalutara District Planters' Association, on the subjects of *Fomes lignosus* and *Phytophthora palmivora*.

1.4. Publications

The following papers were prepared for publication during the year by the staff of the Plant Pathology Department:—

(*a*) Annual Review of the Plant Pathology Department for 1960.

(*b*) Contribution on *Fomes lignosus* to the "Question Corner" of the Rubber Research Institute of Ceylon, Quarterly Journal, **37,** 24.

(*c*) Contribution on *Phytophthora palmivora* to the "Question Corner" of the Rubber Research Institute of Ceylon, Quarterly Journal, **37,** 24–25.

(*d*) Algal Spot of *Hevea* Leaves in Ceylon. Rubber Research Institute of Ceylon, Quarterly Journal, **37,** 49–50.

(*e*) Contribution on *Phytophthora* Control in South India to the "Planting Topics" of the Rubber Research Institute of Ceylon, Quarterly Journal, **37,** 51–52.

2. LABORATORY WORK

2.1. Diseased Specimens.—Laboratory observations were made on the following diseases and pests found on specimens sent in to the Institute in connexion with advisory work, during the period under review.

Identity of diseases, pests and other causes of damage	No. of cases
(*a*) *Fungi and bacteria*	
Botryodiplodia theobromae ...	1
Corticium salmonicolor ...	1
Fomes lignosus ...	8
Fomes noxius ...	2
Gloeosporium alborubrum ...	13
Helminthosporium heveae ...	1
Oidium heveae ...	15
Phytophthora palmivora ...	2
(*b*) *Pests and other causes:*	
Algae ...	1
Ants ...	1
Caterpillars ...	1
Cockchafer grubs ...	1
Chemicals ...	1
Lightning ...	1
Malformations ...	1
Radiation ...	2
Scale insects ...	1
Water deficiency ...	4
Water logging ...	1
Wind ...	3
Other causes ...	2

3. LEAF DISEASES

3.1. Oidium Leaf Disease

3.1.1. General.—The incidence of *Oidium* leaf disease was generally light in sulphur dusted areas throughout the rubber growing districts of Ceylon, during the 1961 refoliation season. A few relatively heavy outbreaks of the disease occurred where adequate control measures were not adopted in areas planted with clones, like Tjir 1, Tjir 16 and BD 5, which are particularly susceptible to the disease.

The weather conditions during the wintering and refoliation period were not conducive to the development of the causal fungus, *Oidium heveae*, and consequently the control of this disease did not generally present any serious problems in 1961.

3.1.2. Field Experiments.—The Plant Pathology Department carried out five field experiments designed to compare the relative merits of spraying with that of dusting for the control of *Oidium* leaf disease.

Wettable sulphur, sprayed at the rates of 24 and 30 oz per acre per round, was compared with sulphur dust used at the rates of 10 and 12 lb per acre per round. Dusting and spraying rounds were uniformly spaced at intervals of seven days. The spraying machine used was the Mistral III AB power sprayer described in the Annual Review for 1960.

The results of these experiments confirmed those of last year, showing that, provided adequate coverage of the foliage is obtained, equally good, or even better, control of *Oidium* leaf disease can be achieved by spraying with wettable sulphur as by sulphur dusting. The rate of application of wettable sulphur for adequate control of the disease will vary between 24–30 oz per acre per round, according to weather conditions, susceptibility of the clone and general incidence of *Oidium*.

3.2. Phytophthora Leaf Disease

3.2.1. General.—The incidence of *Phytophthora* leaf disease was negligible till about the middle of August, but some estates reported heavy leaf fall caused by this disease in late August and September, the wet conditions prevalent during that time of the year being favourable for the development of the causal fungus, *Phytophthora palmivora*.

The rainfall figures for Dartonfield Group from May to September 1961 are shown below to give an indication of the weather conditions prevalent during the *Phytophthora* season.

Station	RAINFALL									
	May		June		July		August		September	
	5 Yr. Av.	'61	5 Yr. Av.	'61	5 Yr. Av.	'61	5 Yr. Av.	'61	5 Yr. Av.	'61
Dartonfield ...	18.66	23.51	15.94	9.99	21.51	13.13	9.93	16.49	12.07	24.57
Hedigalla ...	20.22	20.33	19.11	9.80	12.13	13.34	13.66	19.27	13.22	19.70
Nivitigalakele	19.10	23.07	16.80	10.18	11.72	13.88	10.16	14.29	12.22	23.66

3.2.2. Field Experiments.—During the *Oidium* control experiments, carried out early in the year, chemicals which induce flower fall were applied together with

wettable sulphur, in order to test the feasibility of controlling *Phytophthora* leaf disease indirectly by reducing the fruit set, and thereby one of the major sources of inoculum of *Phytophthora palmivora*.

Nine field experiments designed to compare dusting with spraying, as well as to test the relative merits of different dusting, water-based and oil-based spraying preparations for the control of *Phytophthora* leaf disease, were carried out during 1961. The fungicidal preparations used in these experiments were either copper-based or organic materials, and some of these contained stickers.

3.2.2.1. Indirect control.—The results of the experiments carried out with different chemicals inducing flower fall showed that although fruit set can be reduced to a certain extent by artificial means, the desired objective of controlling *Phytophthora* leaf disease indirectly cannot be achieved by this method, due to practical and economic reasons. This method has a number of shortcomings such as (*a*) the practical difficulties in obtaining a complete elimination of fruiting. (*b*) the danger of damaging young leaves (*c*) the high cost of the necessary chemicals.

These experiments showed that it was not practicable to eliminate fruiting entirely by the use of chemicals; because the flowering period in rubber is rather protracted, and certain clones flower again later in the season. The concentration of the chemicals used was also found to be extremely important, the margin between the safe concentration causing flower drop alone, and that leading to leaf damage, being critical.

It should also be borne in mind that fruiting, although a major factor, is not the only one determining the outbreak of *Phytophthora* leaf disease in a particular field. The disease can occur in fields where there are very few fruits; as the pathogen can be wind-borne over quite considerable distances. It is not possible, therefore, to dispense with protective copper dusting completely in fields treated with flower-destroying chemicals. These factors, together with the high cost of materials, militate against the use of this method for controlling *Phytophthora* leaf disease.

3.2.2.2. Spraying and Dusting Experiments.—The results of the field experiments for the control of *Phytophthora* leaf disease were rather disappointing due to the low, and in some cases, even negligible incidence of the disease in some of the experimental areas, and consequently a number of experiments did not provide conclusive results.

The assessable data available, however, confirmed the preliminary indications obtained during the 1960 *Phytophthora* leaf disease season, that early dusting, carried out before the onset of the South West monsoon season and well before the actual outbreak of the disease, is ineffective for its control. This is due to the fact that copper-based dusts, even those formulated with stickers, probably wash off readily from leaf surfaces after application. The ideal material for the control of this disease would be an effective fungicide, which can be applied before the monsoon rains begin and which would persist on the leaves right through the season. The most promising results on these lines were obtained with a water suspension of copper oxychloride (57% at 2 lb per acre per round) to which is added a new low volume formulation. This mixture gave good control of the disease, showing that it had the desirable qualities of fungicidal activity and rainfastness. Detailed experiments will be carried out on this subject by the newly appointed Agricultural Engineer, who is working in conjunction with the Plant Pathology Department.

3.3. Gloeosporium Leaf Disease

3.3.1. General.—The incidence of *Gloeosporium* leaf disease was light throughout the major part of the year. Heavy outbreaks of the disease occurred, however,

on certain estates during the wetter periods of the year, *i.e.* in March-April and again in August-September.

It now appears that *Gloeosporium* leaf disease, which in the past caused negligible damage to *Hevea*, may become a perennial problem in Ceylon. As the causal fungus of this disease is rather difficult to control, laboratory screening tests of likely fungicides followed by preliminary field experiments for the control of this disease are ensivaged for 1962.

3.4. Helminthosporium Leaf Disease

This disease, caused by the fungus *Helminthosporium heveae*, was recorded occasionally during the year, especially in nurseries, but did not cause damage of any economic importance. The disease is readily controlled by the methods recommended by the Institute.

4. BARK AND STEM DISEASE

4.1. Black Stripe Disease

4.1.1. General.—The incidence of Black Stripe, caused by the fungus *Phytophthora palmivora*, followed a similar pattern to that of leaf fall caused by the same fungus. Serious outbreaks of the disease occurred during August and September in certain areas.

Unfortunately, the high-yielding clone PB 86, which is planted over a major proportion of the replanted area in Ceylon, is susceptible to Black Stripe. It is therefore apparent that the control of this disease is going to assume even greater importance in the economy of the rubber growing industry of this country in the near future. With this factor in view, the Institute is constantly testing new fungicides and methods of application so as to be in a position to advise the grower on the best and most economic methods of controlling this disease.

4.1.2. Laboratory and Field Experiments.—Studies on the biology of the casual fungus and host parasite relationships were continued in the laboratory.

Several water-miscible and waterproof fungicides were tested in the laboratory and in the field. In this year's laboratory tests too, the organo-mercurials proved to be the most effective against Black Stripe; the fungitoxic properties of Antimucin, Ceresan, Panogen, and Verdasan being outstanding. There were no significant differences between the properties of these materials under the conditions of the tests. The performance of these materials under field conditions is being tested at present, and the preliminary indications are that all these materials will prove equally effective under field conditions.

The experiments with waterproof fungicides are being continued and the results will be ready for assessment during 1962.

4.2. Pink Disease

4.2.1. General. –The incidence of Pink disease was negligible during the year, and wherever the disease occurred it was easily controlled by the methods recommended by the Institute.

4.3. Diplodia Die-back

4.3.1. General.—Die-back caused by secondary infection by the fungus *Botryodiplodia theobromae* is of negligible importance on rubber plantations in Ceylon at present. This can be ascribed to the good control of *Oidium* generally obtained on a majority of estates now, as evidenced by the fact that depradations by this fungus can still be observed on certain neglected plantations where heavy leaf-fall due to *Oidium* attack is common. The initial cause in these instances is the starvation of the twigs due to repeated defoliation by *Oidium* leaf disease. The twigs thus weakened become susceptible to the die-back fungus.

5. ROOT DISEASES

5.1. White Root Disease—Fomes lignosus

The incidence of White Root disease caused by the fungus *Fomes lignosus* in young replanted areas continues to be a source of grave concern to the rubber planting industry. The importance of carrying out the control measures recommended by this Institute against this disease cannot be over-emphasized.

In the latter half of 1960, the Institute distributed a questionnaire to ninety-eight estates so as to obtain information on the incidence of White Root disease in the different rubber growing districts and to assess the effectiveness of organo-mercurials in its treatment. The estates were especially requested to provide accurate information on the number of infected trees treated with organo-mercurial fungicides and the number of trees subsequently cured.

The data obtained from this survey are summarized below:—

Districts	No. of Estates returning Questionnaire	No. of Estates reporting incidence of *Fomes lignosus*	Average effectiveness of treatment with organo mercurial fungicides	
			1959	1960
Kalutara ...	22	18	62.1%	79.4%
Kelani Valley ...	28	25	80.9%	81.0%
Galle ...	13	10	64.4%	79.9%
Ratnapura ...	21	16	84.7%	85.6%

These results show that organo-mercurial fungicides have achieved a high degree of success in the control of *Fomes* on infected trees.

Controlled experiments for testing out the efficiency of organo-mercurial fungicides and also for comparing the merits of these materials with other fungicides for *Fomes* control under field conditions will be carried out in 1962.

6. OTHER PESTS AND DISEASES

6.1. General

Damage caused by insects and other pests was of no economic importance on rubber during the period under review. A few cases of borer (*Xyleborus* spp.) attack of exposed wood, following canker scraping, and of mite attack of young plants were observed during the year; but these responded well to routine treatment recommended by the Institute.

7. FIELD EXPERIMENTS

7.1. Dartonfield 1 Acre, 1953 Replanted Area

This area is planted with mixed local and foreign clones for studies on resistance to *Oidium* and *Phytophthora* leaf diseases and for small-scale field trials.

The trees were pollarded early in the year to facilitate observations on the new foliage.

REVIEW OF THE SOILS DEPARTMENT

By

A. J. Jeevaratnam

SUMMARY

The staff position in the Department deteriorated during the second half of the year when the two Research Assistants resigned from their posts, one to take up an appointment at the University of Ceylon and the other due to ill-health.

The advisory work of the Department increased during the year as shown by the amount of correspondence, the number of visits to estates and of soil, leaf and latex analyses for advisory purposes.

Foliar diagnosis and soil analysis have been used in the past for advisory recommendations on manuring. During the year the results of leaf analysis were, in certain instances, interpreted on the basis of balanced ratios, as done in the work on Physiological Diagnosis, for recommending remedial treatments.

Laboratory investigations were mainly concerned with the investigations on the applicability of the technique of "Diagnostic Physiologique" under Ceylon conditions. Altogether 731 leaf samples and 294 latex samples were analysed. Investigations on the applicability of 'norms' used for Physiological Diagnosis were carried out to study the variations in mineral content of samples taken,

(*a*) at different times of the year
(*b*) from different types of planting material
(*c*) and from different positions on the tree

These investigations revealed that there can be wide variations due to each of the factors mentioned above.

The field experiments laid down to determine the response of rubber trees to fertilizer applications based on the results of leaf and latex analyses according to the technique of Physiological Diagnosis were intensively pursued during the year. Twenty six of these experiments, started in 1960, were in progress. Four more experiments were commenced in 1961. Out of the total of thirty experiments now in progress, eight are of a statistical layout, four on mature areas and four on immature areas. The collection of leaf and latex samples from the experimental plots, their analysis in the laboratory to diagnose the fertilizer requirements, and the supervision of fertilizer applications to experimental areas were carried out satisfactorily with the co-operation of all the members of the Soils Department staff.

Girth measurement records from the experimental plots on immature areas and yield records from the experimental plots on mature areas have been maintained. The results obtained so far do not show significant differences in yield or growth as a result of manuring according to Physiological Diagnosis, but some very interesting trends have been recorded. These experiments should be continued for a considerably longer period of time before any valid conclusions can be drawn. In experiments of this nature, particularly on a perennial crop such as *Hevea*, it is advisable not to draw any interim conclusions.

Apart from the field experiments on Physiological Diagnosis there were eight other field experiments in progress, comprising one nursery manurial trial, one experiment on planting-hole application of fertilizers, five manurial experiments and one manurial-*cum*-cover crop experiment.

It has been found possible to obtain sufficient growth of plants in seedling nurseries within a period of ten months to bring a good proportion of plants to buddable size, by adopting a programme of land rejuvenation followed by intensive manuring. It would thus be possible to obtain planting material of a very high quality if plans are made only a year ahead of the proposed time of field planting.

A planting-hole experiment has indicated that the application of a NPK + Mg fertilizer mixture to the planting hole would be more favourable for the growth of young *Hevea* plants in the field than the application of rock phosphate or of animal meal.

The yield records for the first full year of tapping of the manurial-clone trial at Hedigalla have shown no interaction between fertilizer treatments and the clones tested. This means that clones AVROS 255, LCB 870, PB 86, and PB 86 crown-budded with LCB 870, have responded to fertilizer treatments in a similar manner.

An experiment, carried out on buddings of six clones in a 1958 replanting, to study the effect of low and high potash mixtures on growth has shown a greater variation in growth between clones, PB 86 being the slowest grower, than between manuring treatments.

Four new field experiments have been laid down in replantings planted during the South-West monsoon season of 1961. Two of the experiments were sited in an area of twenty acres replanted at the R.R.I.C. Sub-station at Kuruwita.

The cultivation of Guatemala grass in rubber plantings and the use of loppings of this grass for mulching purposes seem to have posed certain problems when adopted on a commercial scale. Investigations have shown that they are surmountable if there is a right understanding of the purpose for which this agricultural practice has been recommended. Records maintained by the Soils Department from experimental areas show that this practice has a favourable effect on the growth of rubber plants.

The new herbicide "Paraquat" has been tested and found effective as a total weedkiller. It is now being tried out in combination with pre-emergence herbicides.

Meteorological recordings have been maintained regularly since the meteorological instruments consisting of wind vane, anemometer, sunshine recorder, automatic-siphon rain gauge, ordinary rain gauge, thermometers, thermohygrograph and earth thermometers (at different depths) were installed on a site opposite the main laboratories at Dartonfield, selected in consultation with the Department of Meteorology.

DETAILED REVIEW

1. GENERAL

1.1. Staff.—The Soils Chemist was on duty throughout the year. The staff position which was very satisfactory during the first half of the year deteriorated during the second half when the two Research Assistants of the Department

resigned from their posts in September. Miss R. Abdul Cader relinquished duties on 15-9-61 in order to take up an appointment at the University of Ceylon. Mr. M. P. Wesentipulle resigned on 30-9-61 due to ill-health. One of the Technical Assistants, Mr. L. Wirasinha, resigned from his post on 21-2-61 on being awarded a scholarship by the Government of New Zealand to study for the degree in Agriculture. Mr. F. P. W. Silva was appointed on 12-6-61 to fill the vacancy.

1.2. Advisory Work.—The volume of advisory work carried out by the Department registered an increase during the period under review. This entailed an increase in the volume of correspondence, visits to estates and analyses of soil, leaf and latex samples for advisory purposes. The subjects dealt with covered varied fields such as mineral deficiencies in the field, backward growth of immature clearings, manuring for disease and wind resistance, cover crops and weed control.

Twenty estates were visited for investigations on backward growth, and soil and leaf samples were brought back for analysis. Wherever it was confirmed that the backward growth was due to nutritional deficiencies, remedial manuring was recommended.

Two estates were visited to advise on cover crops. These visits were made to investigate certain difficulties encountered by the estates in adopting the agricultural practice of cultivating Guatemala grass in rubber plantings and using the loppings of this grass for mulching purposes. These investigations indicated that there was an incorrect appreciation of the purpose of this agricultural practice. The Guatemala grass is not just another cover crop, nor is its primary function that of a wind belt.

Two estates in the Koslanda District were inspected at the request of the Rubber Replanting Advisory Board to determine the suitability of the estates for replanting rubber under the Rubber Replanting Subsidy Scheme. A detailed report was submitted.

The Rubber Controller's nurseries at Egal Oya and Hedigalla were visited for recommendations on manuring. It has been found that the rate of growth of plants in seedling nurseries could be accelerated by adopting a programme of land rejuvenation followed by intensive manuring. Under this system a good proportion of plants can be brought to buddable size within a growing period of ten months for use as budded stumps.

Two rubber planting schemes under the Department of the Land Commissioner were inspected for advisory purposes at the request of the respective Government Agents.

Leaf symptoms of potassium deficiency were in evidence on mature areas of clone PB 86 on one estate while those of magnesium deficiency were reported from several estates on both young and old plantings of clone PB 86.

1.3. Correspondence.

	Inward	*Outward*
General	59	66
Technical	545	432

1.4. Visits.

	Soils Chemist	*Research Assistant*	*Senior Technical Assistant*
Advisory	18	3	6
Field Experiments on R.R.I.C. Experimental Stations and Sub-station ...	19	7	1
Experiments on outside estates ...	27	6	19
Miscellaneous	23	2	6
	87	18	32

1.5. Visitors.—An important visitor to the Department during the year was Dr. F. R. Moorman, Expert on Soil Classification from the F.A.O., who inspected soils of the rubber growing areas, accompanied by the Soils Chemist, from 21st to 23rd April.

1.6. Meetings.

Soil Conservation Society	1	19/11.
Kalutara District Planters' Association ...	2	25/1 & 17/3.
Soil Conservation Symposium	1	17/11.
Ceylon Association for the Advancement of Science	2	23/11 & 24/11.
Meeting of the Sub-committee on Fertilizer Act No. 21 of 1961	1	2/12.

1.7. Publications.

(*a*) Annual Review of the Soils Department for 1960.

(*b*) A paper entitled, "Comparative Studies on the Chemical Composition of some Cover Plants" presented at the Natural Rubber Research Conference, Kuala Lumpur in September 1960 was reproduced in the *Rubb. Res. Inst. Ceylon Quart. J.***37,** 33–42.

(*c*) A contribution to the Question Corner of the *Rubb. Res. Inst. Ceylon Quart. J.***37,** 132.

2. LABORATORY WORK.

The major volume of laboratory work was done in connexion with investigations on the applicability of the technique of Physiological Diagnosis under Ceylon conditions. A total of 731 leaf samples and 294 latex samples were analysed. Most of the samples were from field experimental plots. Others were collected for the investigations on the applicability of 'norms' used for Physiological Diagnosis.

Investigations on soils were curtailed during the period under review. Soil samples were analysed only when it was deemed necessary for advisory purposes.

2.1. Advisory Service based on Soil and Plant Analysis.—Leaf and/or soil samples were analysed from twenty estates for advisory purposes. On three of the estates it was recommended that observational plots be laid down to compare standard manuring with "DP" manuring.

2.2. Variations in mineral content of leaves due to sampling at different times of the year. —Leaves of apparently healthy trees of clones PB 86, RRIM 501 and Gl 1 were sampled at monthly intervals from pre-war replantings established at the Institute's experimental station of Dartonfield. These areas have been systematically manured according to Institute's recommendations and were considered to be in an apparently healthy condition. Leaves from five selected trees of each clone were sampled separately, as from January 1960. Samples were taken, whenever possible, from branches of limited growth *i.e.* shaded leaves inside the crown from short and thin branches borne on the main or primary branches and carrying only one whorl of leaves, according to the technique of Physiological Diagnosis. Whenever it was not possible to obtain samples from branches of limited growth, samples were taken from other shaded low branches. Latex samples were also collected from the selected trees at the time of collecting leaf samples.

The results showed that from about three months after refoliation up to about November the mineral content of the leaves remained more or less at a constant level, after which time changes took place prior to the onset of "wintering". This pattern held good for the elements N, P, K, Mg, Cu and Mn. In respect of calcium there was a tendency for this element to increase as the leaves became older.

2.3. Variations in mineral content of leaves due to differences in Planting Material.—For this investigation leaf and latex samples from different types of planting material have been sampled at different times of the year and analysed.

The results indicate that the level of mineral elements can vary with the type of planting material. In some instances these variations are not wider than the variations that have been noted in samples taken from different positions on the same tree, or in samples taken from different trees of the same clone in the same area.

Another practical drawback in this investigation was the selection of "healthy" trees from the different clones for comparison.

2.4. Variations in mineral content of leaves due to sampling from different positions on the tree.—Preliminary investigations were carried out to study the variation in mineral content of leaf samples collected from three different positions on the tree. Analysis of leaves collected from branches exposed to sunlight, from branches in the shade and from spur shoots on trees of clones PB 86 and RRIM 501, indicated that there can be fairly large differences in the nutrient content of the leaves sampled from these different positions on the tree.

These investigations served to emphasize the strict procedure that should be followed in sampling leaves for physiological diagnosis.

2.5. Bulk soil samples from Dartonfield and from an estate in the Kegalle District were collected for characterization of the differences in the nutrient status of the two types of soils.

Soil samples were also collected from an experimental area at Kuruwita Substation on a plot basis for soil fertility studies.

Forty-five soil samples were received and analysed in connexion with advisory work.

3. FIELD EXPERIMENTS

Field experimental work continued to demand a good proportion of the working time. There were eight experiments in progress at the beginning of 1961. Four more experiments were laid down during the year, of which two were sited in an area of twenty acres planted at the R.R.I.C. Sub-station at Kuruwita. The planting of this area was done according to experimental requirements under the supervision of the Soils Department staff.

The eight manurial trials were made up of one nursery manurial trial, one planting-hole experiment, five manurial trials and one manurial-*cum*-cover crop experiment. A new nursery manurial trial was started at the end of 1960 and the old one was terminated in June 1961.

The last two, out of the five, $4 \times 4 \times 4$ NPK experiments sited at Halpe and Ederapolla Estates were terminated by the middle of the year. Remedial manuring of experimental plots, that have had a set-back in growth due to treatments, was carried out at Ederapolla Estate at the Superintendent's request.

Field experiments on Physiological Diagnosis consisted of eight trials that were laid down on a statistical basis and twenty-two observational plots of a comparative nature. Of the eight statistically laid out experiments, four are on mature areas and four on immature areas.

3.1. Manurial Trials.

3.1.1. Manurial-Clone Trial: O, P, NP, PK and NPK Trial, 1952 Clearing, 13½ acres, Hedigalla.

In this experiment the above treatments are being tested in a Latin Square, each plot of which contains four clones : AVROS 255, PB 86, LCB 870, and PB 86 crown-budded with LCB 870.

Girth measurement records were maintained up to the time of commencement of tapping.

The experimental area was brought into tapping from June 1959.

The yield records for 1960 were analysed statistically and the following indications have been obtained : The yields are expressed as grams of dry rubber per tree per tapping.

Clone	AVROS 255	PB 86 crown-budded with LCB 870	PB 86	LCB 870	Sig. Diff.
Mean yield ...	17.81	12.54	21.81	6.30	0.96

(*a*) There are highly significant differences in yield between clones; clone PB 86 being the highest yielder and clone LCB 870 being the lowest yielder.

Fertilizer Treatment	P	NP	PK	NPK	Sig. Diff.
Mean Yield	13.98	14.77	15.52	14.02	1.07

There was no significant difference between the fertilizer treatments P alone, NP and NPK. Treatment PK was significantly superior to P and NPK.

There was no interaction between fertilizer treatments and clones tested. This means that all clones responded to the fertilizer treatments in a similar manner.

3.1.2. 4×4×4 NPK Manurial Trials.—The last two out of the five trials of the above design at Halpe and Edenapolla Estates were given two applications of fertilizers up to June 1961, after which the girth measurements were taken and the experiments were terminated.

The results from all five experiments will be summarized and reported on separately.

Remedial manuring of plots that had received a set-back in growth due to treatments was carried out at Edenapolla Estate at the request of the Superintendent.

3.1.3. Experiment to investigate the effect of high and low Potash mixtures on six clones.—Fertilizer mixtures R.4 : 6 : 2, R.4 : 6 : 3, R.4 : 6 :5 and R.4 : 6 : 8 were tested on clones PB 86, GT 1, RRIC 28, RRIC 45, IRCI 2 and RRIM 605.

The average girth measurements in inches at the end of 1961 were as follows :

Clone ...	PB 86	GT 1	RRIC 28	RRIC 45	IRCI 2	RRIM 605
Mean Girth ...	8.54	10.54	11.03	11.03	10.78	10.23

Fertilizer Treatment	R. 4:6:2	R. 4:6:3	R. 4:6:5	R. 4:6:8
Mean Girth ...	10.50	10.50	10.38	10.06

3.1.4. NPK Trial—Moneragala District without the Nil level .

Planting material—Tjir 1 seedlings.
Date of Planting—November 1958.
Planting-hole application—Nil.
Plot size—Effective plot size is 49 plants with additional plants along boundary rows.

The girth measurements recorded at the end of 1960 showed that there was a significant response to the second level of N, P and K applications which is double the present recommended dosage.

3.1.5. NPK Mg Experiment.—A $2 \times 2 \times 2$ factorial experiment with NPK at 2 levels with split plot arrangements for comparing two forms of magnesium (as commercial Epsom salts and as Dolomite) was laid down in an area of eight acres replanted at the R.R.I.C. Sub-station at Kuruwita in June 1961.

3.1.6. Experiment to study the effect of Nitrogen, Phosphorus and Magnesium supplied by different fertilizers on the growth of Hevea.—A $3 \times 3 \times 3$ factorial experiment in which nitrogen was applied as urea, sulphate of ammonia and sodium nitrate ; phosphorus was applied as Saphos rock phosphate, ammonium phosphate, and superphosphate ; and magnesium was applied as commercial Epsom salts, kieserite and dolomite, was laid down in an area replanted in May 1961 on Gallawatte Estate. Potassium was applied as muriate of potash to all treatments.

3.1.7. Proprietary Fertilizer Comparison Trial.—Several advantages are claimed for the use of complete concentrated fertilizers in preference to mixtures of inorganic fertilizers. Two proprietary complete concentrated fertilizers that have the same analysis as the standard fertilizer mixture—one of Italian origin and another of Dutch origin—are being tested against inorganic fertilizer mixtures applied:

(*a*) as R.4 : 6 : 3 + Mg standard fertilizer mixture

(*b*) as determined by foliar diagnosis.

The four treatments are tested in a randomized block experiment laid down in an area replanted in 1961 on Gallawatte Estate.

3.2. Miscellaneous Field Experiments.

3.2.1. Nursery Manurial Trial.—The diameter of the plants at a height of three inches from the base of the plants was taken with a pair of callipers before the commencement of the experiment (*i.e.* December 1958) and again in December 1960. This experiment was terminated in June 1961 after the seedlings had been budded for use as budded stumps. The results indicate that the addition of magnesium as commercial Epsom salts to seedlings in nurseries had no significant effect on their growth up to a period of two years.

3.2.2. Planting-Hole Experiment.—An experiment to study the response of young *Hevea* budded stumps to applications of the following fertilizers in the planting hole and for four subsequent applications, up to a period of one year, was laid down in an area replanted in May 1960, on Gallawatte Estate as a randomized block experiment.

The fertilizer treatments were

Saphos phosphate
Animal meal (Sterameal)
R.4 : 6 : 3 + Mg
Control.

The girth measurements taken at a height of 3 ft. from the union at the end of one year's growth gave the following results :

Fertilizer Treatment	Saphos Phosphate	Animal meal (Sterameal)	R. 4:6:3 + Mg	Control
Mean Girth in Inches	2.84	3.22	3.62	2.79

It would seem that application of an NPK + Mg mixture to the planting hole at the time of planting and for one year thereafter has a more favourable effect on the growth of young *Hevea* plants than applications of rock phosphate or of animal meal (Sterameal).

3.3. Manurial-Cum-Cover Crop Experiments.

3.3.1. 3 × 3 × 3 K, Mg, Cultivation Treatments Experiments.—Parambe Group, two replications.

All treatments were given a basic application of nitrogen and phosphorus at rates recommended by the Institute.

K levels 0, 1, 2. Level 1 is equivalent to the level of K in R.4 : 6 : 3.
Mg levels 0, 1, 2. Level 1 is equivalent to the level of Mg in R.4 : 6 : 3 + Mg

Cultivation treatments.

O—Cover crop *Pueraria phaseoloides* and no mulching.
1—Cover crop *Pueraria phaseoloides* and mulching with *Pueraria.*
2 –Cover crop *Pueraria phaseoloides* and *Tripsacum laxum* and mulching with *Tripsacum.*

Planting material—PB 86 budded stumps.
Date of planting—May 1959.
Planting-hole application—Nil.
Plot size—40 stumps.

Girth measurement records at the end of 1960 gave the indication that the quadratic response to K is significant.

3.3.2. 3 × 3 × 3 N, P, Cultivation Treatments Experiments.—R.R.I.C. Sub-station, Kuruwita, two replications.

This experiment, which is very similar to the experiment described under section 3.3.1. with the variation that N and P were substituted for K and Mg in the main treatments, was laid down in an area of twelve acres replanted at the R.R.I.C. Sub-station at Kuruwita in June 1961.

3.4. Field Experiments to test the response of Hevea to fertilizer applications according to Physiological Diagnosis.—Several field experiments were laid down in different areas in Ceylon to determine the differential response of manuring according to Physiological Diagnosis compared with application of fertilizers according to the recommendations of the Institute. It was felt

that it would be advisable to assume that the 'norms' established in South-Vietnam were applicable under Ceylon conditions for purposes of determining fertilizer requirements according to ' DP ' in these experiments. This assumption may be justified since the average absolute values established for healthy trees in Ceylon in 1954 were in general agreement with the values reported from South-Vietnam.

It was appreciated that the system of manuring according to 'DP', apart from the difference in the method of determining fertilizer requirements had other variations in actual practice compared with the prevailing system of manuring. Two important variations were:

(1) Inclusion of trace elements in the fertilizer mixture in 'DP' manuring when the diagnosis indicated the need for these.

(2) Differences in fertilizers used as sources of nitrogen and phosphorus.

Hence the experiments were designed to cover these variations as well.

Replicated experiments of a randomized block design were laid down to compare three, four or five of the following treatments depending on the availability of resources:—

1. NPK + Mg fertilizer mixture, *e.g.* R.4:6:3 + Mg (standard). Compounded with sulphate of ammonia as the nitrogen source and rock phosphate as the phosphate source.

2. NPK + Mg fertilizer mixture, *e.g.* R.4:6:3 + Mg (special). Compounded with urea as the nitrogen source and ammonium phosphate as the phosphate source.

3. 'DP' Mixture (Complete). Application of trace elements included when the diagnosis indicated the need for these.

4. 'DP' Mixture (Partial). Trace elements excluded.

5. Control—No fertilizers.

Eight experiments were laid down, four on mature areas and four on immature areas. In all the experiments, except in one on an immature area, about 225 to 250 trees (the size of a tapping task in Ceylon) were treated as one plot. Large plots of this order had to be taken for convenience in recording yield data. The tappers were rotated when and where conditions were favourable in order to offset the influence of tappers on treatments. It is appreciated that for experimental purposes there were a number of drawbacks. But it was felt that any differential response to treatment should be sufficiently large under these conditions for it to be applicable under commercial conditions.

The sampling and analytical procedures according to the technique of Physiological Diagnosis were strictly adhered to, except that when spur 'shoots' were not always available, leaves from other low branches were collected. Records of girth measurements in immature areas and yield data from mature areas have been maintained.

Results:

The results from experiments that have been in progress for periods ranging from one year to two years, both in young and mature areas, have not shown any significant differences in growth or yield according to treatments.

It should be stated, however, that the control treatment was included only in one of the experiments since all the experiments for this investigation were laid down on commercial estates where young plantings cannot be left unmanured for any length of time. It is interesting to place on record that even in this one experiment there has not so far been any significant difference in the yield between the control and the manured plots.

4. SOIL SURVEY.

No work was undertaken under this heading. An application was made to the Ministry of Agriculture, Land, Irrigation and Power to solicit the help of the Canadian Physical Resources Survey Team to carry out first, a reconnaissance survey and then a detailed survey of the rubber growing areas. This request was withdrawn after the visit of Dr. F. R. Moorman, F.A.O. Soil Classification expert, to the Institute. It was felt that it would be desirable to have detailed information on the scope of the survey and Dr. Moorman expressed his willingness to include this in his report to the Department of Agriculture.

Some soil profiles were examined in different rubber growing areas by the Soils Chemist and Dr. F. R. Moorman.

5. COVER CROPS.

5.1. Rhizobial Strains for Nitrogen Fixation in Leguminous Cover Crops. Rhizobial cultures were issued to estates that applied for them. Four new strains of rhizobia were obtained from Australian sources during the year.

5.2. Survey of existing Cover Crops.

5.2.1. Guatemala Grass (*Tripsacum laxum*).

There have been reports that Guatemala grass competes with rubber for nutrients. But none of these reports was substantiated with comparative data to show that Guatemala grass has had an unfavourable effect on the growth of *Hevea*.

It would appear that the purpose for which Guatemala grass has been recommended for cultivation in rubber plantings has not been rightly understood.

6. WEED CONTROL.

The new herbicide 'Paraquat', previously known as PP 910 and now known by the trade name 'Gramoxone', has been tested as a total weed-killer at concentrations recommended and was found effective.

Further trials with this chemical, alone and in combination with pre-emergence herbicides, are in progress.

7. METEOROLOGY.

Meteorological Observations.—

A suitable site opposite the main laboratories was selected by an official of the Department of Meteorology for a meteorological station. The following instruments have now been installed and daily observations have been made from 1st June 1961:

1. Wind vane
2. Anemometer
3. Sunshine Recorder
4. Ordinary rain gauge
5. Automatic siphon rain gauge
6. Thermohygrograph
7. Thermometers (maximum, minimum, wet and dry)
8. Earth thermometers at depths of 4", 8" and 4'.

Rainfall:—

Recordings of rainfall duration and intensities were made on automatic-siphon rainfall recorders (pluviographs) at ten different locations in the rubber growing areas of Ceylon. These recorders have been installed on the following collaborating estates:

1.	Atale Group	Kegalle
2.	Doloswella Group	Nivitigala
3.	Eladuwa Estate	Matugama
4.	Elpitiya Group	Elpitiya
5.	Nakiadeniya Group	Nakiadeniya
6.	Parambe Group	Undugoda
7.	R.R.I.C. Dartonfield	Agalawatta
8.	R.R.I.C. Experimental Station, Hedigalla ...	Badureliya
9.	R.R.I.C. Experimental Station, Nivitigalakele ...	Matugama
10.	R.R.I.C. Sub-station	Kuruwita

REVIEW OF THE CHEMISTRY DEPARTMENT

By

K. F. Heinisch

SUMMARY

Apart from the usual advisory activities experimental work has been concentrated on the reduction of copper and manganese contamination of scrap crepe. It has been found that scrap rubber often has a naturally high content of copper and manganese. It has been possible to reduce by a simple operation the copper content below the official specification of 8 p.p.m. The manganese content is simultaneously reduced but remains above the specified 10 p.p.m., except in cases of treatment with hot EDTA solutions.

A systematic analysis of the latex and rubber of 20 clones was commenced and monthly samples have been tested.

Considerable interest has been shown by estates regarding the use of 'Detergent 40E' and trisodium phosphate in reducing the dirt content of scrap rubber. An improvement in colour of the blankets manufactured from the treated scraps has been reported. Crepe manufactured on five estates has been regularly sampled and tested for dirt, copper, manganese and iron.

An appreciable number of estates has been visited to offer advice regarding various problems in the manufacture of smoked sheet, pale crepe, sole crepe and the construction and operation of smokehouses and of crepe drying towers. Suggestions have been made for a minor alteration of the drying towers, *viz.* division into four vertical sections, which will reduce the drying time and make prior dripping unnecessary.

DETAILED REVIEW

1. GENERAL.

1.1. Staff.—The Department consists of the Rubber Chemist, Dr. K. F. Heinisch, the Assistant Rubber Chemist, Mr. M. Nadarajah, the Research Assistant, Mr. S. W. Karunaratne, the Senior Technical Assistant, Mr. D. S. Muthukuda, three Technical Assistants, Messrs. M. T. Veerabangsa, G. G. Gnanasegaram and O. M. R. Sirisena, and eleven minor staff officers. Six to eight casual labourers were made available to the Department as and when required. The Rubber Chemist was on overseas leave from 29-12-60 to 17-5-61 and the Assistant Rubber Chemist acted for him during his absence. Mr. S. W. Karunaratne, B.Sc. (Ceylon), was appointed Research Assistant with effect from 2nd January 1961.

1.2. Advisory Services, Correspondence, Visits.—The volume of advisory work has been heavy. It included correspondence, visits, preparation of reports, examination of technical literature and experiments and tests in the laboratory and factory relevant to the advisory services provided by the Department.

	1960	1961
Correspondence incoming	557	488
Correspondence outgoing	564	413
Unsolicited samples for report or analysis ...	71	60
Visitors to the Department	74	59
Visits by the Staff of the Department (details below) ...	134	210

	RRIC Estates	*Commercial Estates*	*Other Visits*	*Total*
Rubber Chemist	2	2	10	14
Assistant Rubber Chemist ...	26	31	13	70
Research Assistant	36	9	4	49
Senior Technical Assistant ...	1	53	—	54
Technical Assistants	4	11	8	23
				210

1.3. Analytical Section.—The volume of samples and of routine determinations in the analytical laboratory has been as follows:—

	1960	1961
Samples collected at RRIC estates in connexion with experiments	2,670	918
Samples collected from commercial estates for routine analysis	810	998
Determination of:		
Dirt content	2,002	2,980
Ash content	1,201	1,316
Copper	3,414	2,233
Manganese	468	1,044
Iron	467	1,131
Magnesium	—	245
Phosphorus	—	246
Calcium	—	247
Potassium	—	231
Water Extract	—	229
Alcoholic Potash Extract	—	236
Acetone Extract	—	229
Yellow fraction	—	448
D.R.C.	104	448
T.S.	104	448
Nitrogen	—	300
Viscosity	—	250
Miscellaneous	140	369
	7,900	12,630

Physico-chemical determinations and physical tests of research samples are not included in the above figures.

1.4. Publications.—The publications during 1961 to which members of the Department have contributed, include the following:—

1. Annual Review for 1960.

2. Preservation of Sheet Rubber Against Mould. Part I. Mould Growth in Aqueous Media. *Rubb. Res. Inst. Ceylon Quart. J.* **37** (1961) 43–48.

3. Dirt Content of Scrap Rubber, *Rubb. Res. Inst. Ceylon Quart J.* **37** (1961) 13–17. (Reprinted in Times of Ceylon, 29-4-61).

4. Investigations of the Effects of Copper Dusts used to control Phytophthora Leaf Disease. Part I. Copper Contamination of Latex and Scraps. *Rubb. Res. Inst. Ceylon Quart. J.* **37** (1961) 61–74.

5. Investigations of the Effects of Copper Dusts used to Control Phytophthora Leaf Disease. Part II. Removal of Copper. *Rubb. Res. Inst. Ceylon Quart. J.* **37** (1961) 103–111.

6. Technische Klassifizierung von Naturkautschuk, *Gummi, Asbest, Kunststoffe* **14** (1961) 396–398.

7. Polysaccharides of Mycobacterium phlei, *Nature* **189** (1961) 1008–1009.

8. Short notes on the following subjects for inclusion in the "Question Corner" of the Institute's Quarterly Journal:

   Weighing of Latex
   Smokehouses
   Discolouration of Crepe Rubber
   Coagulation in Sheet Manufacture.

1.5. Meetings, Lectures, Visits. The Rubber Chemist visited, during his overseas leave from 19th to 28th March 1961, the Laboratories of the Natural Rubber Producers' Research Association in Welwyn Garden City, Herts, England. The Assistant Rubber Chemist gave a talk on 12-3-61 on the manufacture of smoked sheet, blanket crepe and scrap crepe at a meeting of the Ceylon Estate Staff's Union at Avissawella. He also spoke on "Some Problems of Rubber Manufacture" at meetings of the Kelani Valley Planters' Association at Avissawella on 27-7-61 and of the Southern Province Planters' Association at Galle on 15-9-61.

2. LATEX.

2.1. Approximate Determination of the d.r.c. of Latex. The advisory work in this connexion, which usually involves the testing of estates' metrolacs, demonstrations to estates of the trial coagulation procedure, etc., has been heavy.

2.2. Control of Coagulation. Estates continue to show considerable interest in the use of the recommended bromo cresol green indicator paper and some 500 booklets of this paper have been issued during 1961.

2.3. Clonal Analyses. In order to obtain a survey of the properties of clonal latices under Ceylon conditions, latices from clones Gl 1, PB 86, PB 186, Tjir 1, RRIM 500, RRIM 501, Nab 12, Nab 15, Nab 20, PR 107, Mil 3 2, RRIC 5, RRIC 7, RRIC 52, RRIC 86, Wagga 6278, AVROS 255, AVROS 352, LCB 1320 and of *Hevea benthamiana* (F 4537) were sampled monthly and tested. The results, expressed as mean values over 1961 are summarized in Table 1.

TABLE 1

Clonal Latex—Mean Values 1961

Clone	D. R. C. %	T. S. %	Yellow Fraction %	Viscosity 30°C cp.	Voluminosity	Ash %	Nitrogen %	Water Extract %	Acetone Extract %	Alcoholic Potash Extract %	Copper (ppm)	Iron (ppm)	Manganese (ppm)	Magnesium (ppm)	Phosphorus (ppm)	Calcium (ppm)	Potassium (ppm)	Mooney Viscosity	Colour Index
PB 186	40.62	44.52	16.2	10.19	1.251	1.15	0.59	1.3	4.14	0.49	6.5	23.0	1.5	245	1233	173	3051	69	53
PB 86 (Old)	35.74	39.00	19.7	9.04	1.378	1.60	0.60	2.3	4.00	0.60	6.0	24.0	1.6	1143	1092	143	4494	88	3
RRIM 500	32.62	35.79	25.7	8.86	1.502	2.02	0.68	2.0	3.88	0.42	7.5	30.0	1.3	1346	2369	286	5284	77	16
Nab 12	34.75	38.30	17.8	7.19	1.279	1.83	0.63	1.9	4.73	0.55	8.3	21.8	1.0	748	1487	169	4671	64	21
Nab 15	36.02	39.59	18.2	8.18	1.332	1.57	0.65	2.3	4.41	0.55	4.6	26.3	1.1	585	1205	239	4397	87	14
RRIM 501	34.31	37.43	20.6	7.99	1.401	1.64	0.62	1.3	5.29	0.60	7.6	26.6	1.2	537	1469	146	5086	55	9
PB 86 (Young)	34.65	38.12	21.9	9.23	1.425	1.49	0.67	2.9	4.24	0.62	6.4	24.6	1.7	994	1055	154	4600	84	6
Nab 20	37.33	40.82	15.1	8.48	1.295	1.50	0.64	1.8	4.63	0.58	5.1	23.3	1.3	801	1471	187	4176	84	6
Tjir 1	34.98	38.61	23.1	10.09	1.444	1.59	0.66	2.5	3.76	0.49	6.6	27.1	1.2	1321	2225	139	4804	92	24
Mil 3/2	37.67	40.81	19.9	8.98	1.332	1.49	0.59	2.8	4.22	0.51	5.2	26.9	1.1	564	1358	188	4562	88	5
AVROS 255	35.45	38.53	20.1	8.42	1.371	1.71	0.62	1.4	4.22	0.54	5.4	26.7	1.0	614	1476	203	4474	77	6
AVROS 352	35.48	39.02	23.9	9.94	1.419	1.61	0.61	2.2	6.26	0.56	6.6	33.8	1.0	798	1424	295	5600	79	9
LCB 1320	35.49	38.26	22.2	8.45	1.374	1.57	0.59	2.9	3.94	0.61	5.3	26.3	1.2	1053	1522	158	5105	81	6
PR 107	37.09	40.52	18.5	9.07	1.334	1.57	0.65	2.6	4.10	0.70	5.0	26.6	1.2	483	1857	172	4204	78	5
RRIC 5	33.68	37.12	30.0	8.90	1.462	1.87	0.65	1.7	3.80	0.59	6.9	25.7	1.2	945	2463	126	5174	79	52
RRIC 7	36.33	40.03	27.4	11.67	1.413	1.73	0.67	2.1	4.66	0.48	6.6	29.1	1.2	710	1907	158	4813	92	27
RRIC 52	36.89	40.26	16.5	8.71	1.300	1.50	0.64	2.4	4.55	0.73	6.3	21.6	1.6	770	1120	140	3961	84	9
RRIC 86	36.44	39.81	21.7	11.13	1.413	1.79	0.62	2.6	4.34	0.64	8.2	30.3	1.2	1297	2231	374	4084	81	10
Wagga 6278	36.17	39.84	23.6	11.26	1.480	1.50	0.64	2.7	4.50	0.75	4.7	27.3	1.6	1308	1068	348	3140	89	4
Glen 1	35.95	39.65	21.5	12.30	1.474	2.06	0.62	1.7	4.22	0.61	6.6	30.2	2.0	1802	1401	354	5374	69	13
H. benthamiana (F 4537)	30.77	33.82	4.8	4.11	1.201	1.59	0.64	2.1	5.26	0.60	4.9	29.8	1.2	224	997	107	3852	67	20

2.4. Despatch of Latex.—Samples of fresh latex of clones PB 86 and PB 186 have been sent at regular intervals to the Natural Rubber Producers' Research Association, England. The latex was collected in vessels surrounded by ice and was despatched by air freight in polythene containers packed in ice in a thermos flask.

3. SHEET RUBBER.

3.1. Defects in Sheet.—Various defects in smoked sheet continued to take a part of the advisory work of the Department. In some cases defects have been traced back to the use of acetic acid as latex coagulant. Acetic acid from destructive distillation of wood may contain traces of phenolic substances, which can be oxidized by enzymes causing discoloured patches. The Institute does not generally favour the use of acetic acid, as it increases the risk of fermentation, discolouration and bubble formation.

3.2. Mould on Sheet.—Investigations into the prevention of mould growth on sheet rubber have been continued on an increased scale.

4. CREPE RUBBER.

4.1. Crepe Colour.—For crepe production the latex must be predominantly white. Clones giving a yellow latex cannot be processed into IX crepe because sufficient colouring matter cannot be removed by fractioning and/or bleaching. The colour of latices from Ceylon clones, as well as from foreign clones grown in Ceylon, examined during 1961, was as follows:—

Deep yellow	PB 186.
Yellow	RRIM 500, *H. benthamiana* (F 4537), RRIC 86, RRIC 7, AVROS 352, Tjir 1.
Pale yellow	Nab 12, Nab 15, RRIM 501, Nab 20, RRIC 52, RRIC 5, Gl 1.
White	Mil 3/2, LCB 1320, PR 107, Wagga 6278, PB 86.

Enzymatic discolouration of crepe which occurs when sodium bisulphite is not added to the latex is usually due to the reaction of an enzyme, polyphenol oxidase, with naturally-occurring phenolic substances producing a grey or black discolouration. A half-way stage in the reaction giving a pink pigment is occasionally encountered. The enzymatic discolouration of crepe manufactured by the coagulation of the latex with formic acid and without the addition of sodium bisulphite and RPA 3 gave the results shown in Table 2.

TABLE 2

Enzymatic Discolouration

Slightly discoloured	Discoloured	Badly discoloured
RRIM 500	RRIC 5	RRIC 7
PB 86	*H. benthamiana*	
Tjir 1	Gl 1	
PB 186	PR 107	
Mil 3/2	Nab 12	
RRIM 501	AVROS 255	
RRIC 52	Wagga 6278	
RRIC 86	AVROS 352	
Nab 20		
LCB 1320		
Nab 15		

It has been observed that the latex of clone RRIC 7 contains a high amount of phenolic bodies and gets strongly discoloured if no sodium bisulphite is used in crepe manufacture. Crepe from RRIC 7 latex coagulated without sodium bisulphite may range in colour from amber to dark brown.

4.2. Bleaching of Latex for Crepe Rubber Manufacture.—Experiments to show whether the addition of a zinc salt improves the bleaching action of RPA 3 were carried out. The chemicals used were zinc chloride (0.1%) and a mixture of zinc oxide (0.1%) and ammonia (0.1%), which were added to the latex prior to the addition of bleaching agent and acid. The results show that the addition of zinc oxide and ammonia gave a slightly whiter crepe than the control.

4.3. Mould on Crepe Rubber.—Three mould species were isolated from Ceylon blanket crepe and were identified at the Commonwealth Mycological Institute as:

Penicillium steckii Zal.
Aspergillus awamori Nak.
Aspergillus niger Van Tiegh.

It is interesting to note that the above first two species were not amongst the several species of mould isolated from discoloured Ceylon crepe rubber by Turner and Kennedy, (*Nature* **173** (1954) p. 506).

4.4. Drying of Crepe Rubber.—A new drying tower at Dartonfield has been put into operation. The usual drying tower consists of one large chamber with 2 or more floors in which the laces from different daily productions are hung up on different floors. The humidity of the air in such a tower is dependent on the water content of the wettest laces. If, for example, fresh wet laces are hung up in the lowest floor, humid air will pass along rather dry laces on the upper floor and drying will be delayed. To avoid this delay, the freshly milled laces are put first for 12 to 24 hours on a dripping loft before insertion into the tower, thus increasing the handling time.

If, however, the whole drying space above the bulking chamber is divided into four vertical sections by means of simple separating panels (*e.g.* hardboard), each separate section can be used to accommodate on all floors one daily production, which is completely separated from the crop of the other days. The laces can then be inserted into the drying sections without previous dripping. The drying time of laces of normal thickness (1.2 mm) is then about $2\frac{1}{2}$ to 3 days.

4.5. Scrap Crepe.—Considerable interest has been shown by estates regarding the use of 'Detergent 40E' and trisodium-phosphate which has resulted in a reduction of the dirt content and of the copper and manganese content of scrap crepe. An improvement in the colour of the milled scrap crepe has also been reported from several estates. Means of reducing the naturally-present copper and manganese content are discussed under section 4.9.

4.6. Colouring of Antimucin.—To facilitate the supervision of the use of Antimucin WB as a fungicide it has been customary to colour it with an organic dyestuff or Swedish red powder. Since, however, brokers have reported adversely on the staining of scrap crepe by the use of these dyes, the possibility of using ultramarine blue (Lazulite or Robin Blue) was investigated.

Trials were carried out with Robin Blue at concentrations of 1%, 1.5%, 2%, 2.5% and 3% in diluted Antimucin WB solution. The results show that a minimum

concentration of 2.5% (4 oz per gallon) is required in dry weather and a minimum concentration of 3% (5 oz per gallon) is required in wet weather.

It was also observed that Robin Blue was not entirely soluble in the diluted Antimucin solution. It must be mentioned that although Robin Blue does not discolour the scrap crepe, it may cause an untidy appearance of trees during wet weather.

4.7. Analysis of Commercial Rubber. Samples of crepe manufactured on five estates, collected twice weekly, have been tested for dirt, copper, manganese, ash and iron. The results are given in Tables 3 to 7.

TABLE 3

Percentage Dirt Content of Commercial Samples (2-12-60 to 23-11-61)

Grade	No. of samples	Mean	Highest value	Lowest value	Standard deviation	Variability %
Latex Crepe 1X ...	62	0.024	0.061	0.008	0.0134	56.3
,, ,, 1 ...	192	0.023	0.083	0.003	0.0139	60.6
,, ,, 1A ...	31	0.025	0.058	0.010	0.0133	52.9
,, ,, 2 ...	116	0.022	0.067	0.004	0.0127	56.6
,, ,, 3 ...	154	0.049	0.225	0.009	0.0307	62.7
,, ,, 4 ...	28	0.073	0.190	0.021	0.0516	70.6
Scrap Crepe 1 ...	205	0.426	1.103	0.028	0.2495	58.6
,, ,, 2 ...	230	0.344	1.220	0.065	0.2039	59.3
,, ,, 3 ...	166	1.048	3.663	0.033	0.9587	91.5

TABLE 4

Percentage Ash Content of Commercial Samples (1-12-60 to 30-6-61)

Grade	No. of samples	Mean	Highest value	Lowest Value	Standard deviation	Variability %
Latex Crepe 1X ...	17	0.147	0.193	0.120	0.0170	11.6
,, ,, 1 ...	61	0.157	0.220	0.095	0.0338	21.5
,, ,, 3 ...	6	0.383	0.495	0.215	0.1078	28.1
,, ,, 4 ...	38	0.284	0.545	0.090	0.0889	31.3
Scrap Crepe 1 ...	26	0.516	1.040	0.253	0.1440	27.9
,, ,, 2 ...	32	0.549	0.790	0.323	0.1356	24.7
,, ,, 3 ...	15	0.865	1.423	0.368	0.3095	35.8

TABLE 5

Copper Content of Commercial Samples in p.p.m. (1961)

Grade	No. of samples	Mean	Highest value	Lowest value	% over 8 p.p.m.
Latex Crepe 1X ...	65	1.6	4.9	0.4	—
,, ,, 1 ...	265	1.4	6.6	0.1	—
,, ,, 1A ...	39	1.5	6.2	0.1	—
,, ,, 2 ...	155	1.5	9.5	0.1	1.0
,, ,, 3 ...	163	2.5	18.6	0.2	3.1
,, ,, 4 ...	67	2.9	18.0	0.7	6.0
Scrap Crepe 1 ...	261	5.1	30.8	0.2	11.9
,, ,, 2 ...	253	7.0	38.4	1.1	26.1
,, ,, 3 ...	177	13.9	80.4	1.1	63.3

TABLE 6

Manganese Content of Commercial Samples in p.p.m. (1961)

Grade	No. of Samples	Mean	Highest value	Lowest value	% over 10 p.p.m.
Latex Crepe 1X ...	22	0.8	1.5	0.2	—
,, ,, 1 ...	118	0.9	2.2	0.1	—
,, ,, 2 ...	4	0.8	1.0	0.5	—
,, ,, 3 ...	9	2.2	3.3	0.9	—
,, ,, 4 ...	67	1.6	3.8	0.3	—
Scrap Crepe 1 ...	56	16.3	37.3	1.2	89
,, ,, 2 ...	74	7.3	30.5	1.6	19
,, ,, 3 ...	38	12.0	31.6	3.2	42

TABLE 7

Iron Content of Commercial Samples in p.p.m. (1961)

Grade	No. of samples	Mean	Highest value	Lowest value
Latex Crepe 1X ...	22	33.4	53.2	17.0
,, ,, 1 ...	117	30.7	58.4	6.0
,, ,, 2 ...	4	28.2	42.8	16.8
,, ,, 3 ...	9	132.3	235.0	50.0
,, ,, 4 ...	67	80.4	139.0	24.0
Scrap Crepe 1 ...	56	274.2	815.0	50.0
,, ,, 2 ...	73	248.0	902.5	7.0
,, ,, 3 ...	39	505.2	3520.0	85.0

4.8. Natural Copper, Manganese and Iron Content of Scrap Rubber.—It has been found that consequent to copper dusting and after taking precautions to prevent direct contamination, the copper content of the rubber may increase, indicating that the copper is being assimilated by the tree either through the leaves or through the roots.

Panel scrap very often shows a much higher copper content than the latex film, the increase being far beyond the limits of the analytical error. These discrepancies have been observed regularly since 1957. It has been assumed that the increased copper content is due to contamination of the panel scrap with small bark particles or with soil but this increase in copper content of panel scrap has also been observed in samples where the tapping panel has been completely sealed off with polythene sheeting for protection against any outside contamination.

Samples were collected from a tree of clone PB 86 at regular tapping intervals every other day, utmost care being taken to remove any adhering bark particles. Average copper values of 4.5 p.p.m. for latex and 12 p.p.m. for scrap have been obtained from ten samples, the difference between latex and scrap varying from 1.2 to 9.3 p.p.m. Only in one sample had the panel scrap a lower copper content than the latex.

It may be surmised that the higher copper content of the scraps is caused by a higher content of tyrosinase, a copper-containing enzyme present in latex. Tyrosinase possesses the ability to catalyze the aerobic oxidation of monohydric and

o-dihydric phenols. It has been suggested that this enzyme serves to form a protective coating over injured parts of plants. It is activated after an injury to the tissue and oxidizes phenolic bodies to quinones, which in turn combine with proteins to form the coating over the injured tissue. Assuming that the excretion of the enzyme from the wounded tissue proceeds rather slowly the content of tyrosinase may be expected to be considerably higher in the scraps which remain on the tapping cut for two days.

Besides copper, there is also a naturally high content of manganese and iron in scrap rubber, which is absorbed from the bark and is most probably part of enzymes, as arginine-amidases, iron-porphyrins and cytochromes. The average values in p.p.m. of these metals in scrap from 20 clones for 1961 are shown in Table 8.

TABLE 8

Clonal Panel Scrap
Mean Values in p.p.m. (1961)

Clone	Copper	Manganese	Iron
PB 186 ...	8.5	46.3	586.8
PB 86 (Old) ...	9.5	38.4	647.0
RRIM 500 ...	6.5	18.3	493.1
Nab 12 ...	8.2	26.2	638.8
Nab 15 ...	7.5	37.5	612.0
RRIM 501 ...	11.4	27.2	1653.0
PB 86 (Young) ...	7.5	58.3	748.0
Nab 20 ...	5.1	31.0	1073.1
Tjir 1 ...	10.6	22.1	975.6
Mil 3/2 ...	5.8	22.6	722.8
AVROS 255 ...	5.2	18.1	984.8
AVROS 352 ...	5.5	22.9	624.0
LCB 1320 ...	5.3	23.0	1008.9
PR 107 ...	6.0	17.9	978.3
RRIC 5 ...	6.6	40.2	838.6
RRIC 7 ...	7.1	48.0	859.3
RRIC 52 ...	6.3	28.1	1895.0
RRIC 86 ...	6.7	28.8	1718.3
Wagga 6278 ...	11.1	24.6	1363.2
Gl 1 ...	4.4	42.2	593.8
H. benthamiana (F 4537) ...	5.6	22.5	1108.0

4.9. Limitation of Copper and Manganese Contamination. – A way of removing superficial copper contamination is by using suitable detergents which reduce the interfacial tension between rubber and the copper particles. The copper contaminant may also be removed by sequestring agents which are able to form soluble complexes with the metal ion. Beside the tri- and tetra sodium salt of EDTA (ethylene diamine tetra acetic acid) attention has been concentrated on chemicals with sequestring properties which are normally available in the rubber factory. These are the amino acids present in rubber serum, and oxalic acid which is used as coagulant in crepe manufacture.

Although the main interest has been concentrated on the removal of copper, attention has also been given to the limitation of the manganese content which should be below 10 p.p.m. according to the RMA specification.

It has been shown that soaking of the scrap rubber in dilute solutions of formic or oxalic acid or in fresh factory serum reduces the copper content below the limit

of 8 p.p.m. It appears that the time of soaking may, under certain circumstances, be of importance. A prolonged treatment generally improves the extraction but in the case of oxalic acid or oxalic acid serum (except in combination with 'Detergent 40E') it seems advisable not to extend the soaking for more than one day. as the dissolved and complexed copper precipitates out at a longer soaking period. These treatments have also been found to reduce considerably the manganese content of the scrap rubber although not below the specified maximum of 10 p.p.m. About 2/3 to 3/4 of the iron is extracted at the same time.

Treatment of the panel scraps with a hot 5% solution of the tetra sodium salt of EDTA seems to be very effective in reducing the manganese content below 10 p.p.m. This extraction appears to be dependent on the pH of the solution and is, for manganese, more effective at a high pH (about 10), whereas for copper a lower pH (about 5–6) seems to be required. Some figures are given in Tables 9 and 10.

TABLE 9

Treatment of Scraps for removal of Copper and Manganese

Treatment	No. of days soaking	pH	Cu in p.p.m. in crepe	Mn in p.p.m. in crepe
Water ...	1	7.3	8.3	31
	2	7.5	3.6	25
Detergent 40E (0.1%) ...	1	7.3	6.8	34
	2	7.5	6.7	28
Detergent 40E (0.1%) ...	1	7.9	2.0	25
+ trisodium phosphate (0.1%) ...	2	7.9	3.7	22
Oxalic acid (0.2%) ...	1	1.9	3.4	21
	2	2.3	9.9	15
Oxalic acid (0.2%) ...	1	2.2	2.6	19
+ Detergent 40E (0.1%) ...	2	2.2	8.6	17
Oxalic acid serum ...	1	5.3	2.5	26
	2	6.1	10.7	17
Oxalic acid serum ...	1	5.3	3.3	20
+ Detergent 40E (0.1%) ...	2	5.7	2.3	18
Formic acid serum ...	1	5.0	9.5	21
	2	6.1	5.2	16
Formic acid serum ...	1	5.0	4.3	21
+ Detergent 40E (0.1%) ...	2	5.8	3.8	15
Control, no soaking ...		—	—	39.9

TABLE 10

Treatment of Scraps with Sequestrene NA 4

	pH	Cu (p.p.m.)	Mn (p.p.m.)	Fe (p.p.m.)
5% sol. Sequestrene NA 4 ...	10	6.4	7.5	986
5% sol. Sequestrene NA 4 + HCl ...	6	4.1	14.0	577
Water ...	7	7.9	26.4	1117

5. COMPOUNDED RUBBER.

5.1. Equipment.—The new steam boiler with automatic oil firing has not yet been taken into operation owing to a delay in the availability of Government A.C. supply.

5.2. Plasticity of Raw Rubber.—The plasticity of raw rubber from latex of various clones collected monthly was determined by the Mooney Viscometer and the Hoekstra steam plastometer. From the results obtained the following tentative classification could be made:

Hard:	PB 86, Nab 15, Tjir 1, Mil 3/2, RRIC 7, Wagga 6278.
Medium:	RRIM 500, Nab 20, AVROS 255, AVROS 352, PR 107, RRIC 5, RRIC 52, LCB 1320, RRIC 86, *H. benthamiana* (F 4537).
Soft:	PB 186, Nab 12, Gl 1.
Very soft:	RRIM 501.

The hardness of clonal rubber is important because a hard rubber can stand more bleaching without oversoftening. In sheet rubber, hardness is also important as a soft rubber may extend during smoking, due to its own weight. The plasticity of solid rubber may, however, change as a function of time.

Hardening on storage can be prevented by the addition of formaldehyde to the latex. Hard rubbers are required for sole crepe manufacture and formaldehyde should, therefore, not be added as an anticoagulant to the latex.

5.3. T.C. Rubber.—The position in Ceylon with regard to Technically Classified Rubber has remained unchanged and no commercial production of TC-rubber is anticipated in the near future. The Department collaborated in the yearly inter-laboratory cross-check test arranged by the Rubber Research Institute of Malaya.

6. MISCELLANEOUS.

6.1. Microscopy of Fresh Latex.—Microscopic study of the particles present in clonal latices has shown differences in the amount and type of particles present. The samples of latex were collected one minute after tapping in glass vessels surrounded by melting ice. To facilitate microscopic observation and photography the Brownian-movement of the latex particles was prevented by diluting 10 ml of the field latex to 60 ml with distilled water and mixing 1 ml of the diluted latex with 9 ml of warm 5% gelatine solution. Slides from this solution were prepared and placed in a refrigerator. After a few hours they were examined with an "Ortholux" microscope under phase contrast.

The bottom fraction of fresh centrifuged latex was also examined after diluting it with mannitol buffer in the ratio 1:6 and then with gelatine (1:9). Rubber particles, Frey-Wyssling particles and lutoids were found to be present. A network of threads was also found to which the above type of particles have attachments. This is in agreement with the findings at the R.R.I. of Malaya where the Brownian movement of the latex particles was eliminated by taking the photographs under electronic flash. These threads were found to be unstable and to disappear on storing the slides at room temperature.

The network of threads was conspicuous in latex of a clone of *H. benthamiana*. Latex particles joined by a network of threads were seen in latex from clones LCB 1320 and Tjir 1. An ordered arrangement of Frey-Wyssling particles with no connecting link visible in latex from *H. benthamiana* was seen. A lutoid attached to a thread was found in the bottom fraction of centrifuged latex from clone RRIC 7. The lutoids were also clearly visible in chilled latex collected at the end of the latex flow period. These lutoids sometimes show under the microscope a reddish discolouration, probably due to the action of enzymes. The presence of copper and manganese enzymes in these lutoids may to some extent account for the higher manganese and copper content of latex which is noticeable towards the end of latex flow and in panel scrap.

6.2. Carotenoids.—The nature of the yellow colouring matter of latex was investigated by chromatographic and spectrographic methods. Paper partition chromatography and chromatostrips were tried with little success. Experiments were carried out using chromatostrips having a thin layer of Al_2O_3 according to Brockmann, and with different solvents to serve as a guide for application to columns on a preparative scale.

The yellow fraction was separated according to the method of Resing and chromatographed on a Tswett column using Al_2O_3. The process of separation and of chromatography was repeated several times with fresh samples of latex collected in melting ice, but on each occasion different colour bands were zoned in the column. No red epiphasic pigment was detected. No hypophasic pigment was obtained before saponification.

It is well known that carotenes are very susceptible to air oxidation and isomerization in solutions due to various factors such as photo isomerization, thermal isomerization, isomerization by catalysts including organic acids.

Frey Wyssling globules of the yellow fraction consist mostly of fat and fat-like substances and account for most of the acetone extract residue. Fatty acids can bring about isomerization of the pigments. Pyridine was used to eliminate acid-induced isomerization.

Epiphasic pigments in latex of clone PB 186 were subjected to chromatography on a Tswett column. The following bands were distinct at different stages of development. More bands were separated out when benzene containing 2% methyl alcohol was used.

Stage 1. (*No. of zones* 3)	*Stage* 2. (*No. of zones* 5)	*Stage* 3. (*No. of zones* 6)
Brownish yellow	Brownish yellow	Yellow
Yellow	Yellow	Pink
Orange	Pink	Yellow
	Yellow	Pink
	Orange	Yellow
		Orange

It was noted that an orange fraction eluted out fast when petroleum ether (60–70°C) was used both as the solvent and developing solvent. This pigment taken up in petroleum ether showed absorption spectra maxima at 450 and 480 mu. This corresponds to the absorption spectra maxima of neo-beta-carotene-U, (3-mono-cis-beta-carotene) one of the more stable isomers of beta-carotene. This pigment has been obtained in the crystalline state (Zechmeister).

A coloured hypophase could only be separated after saponification and this was found to be composed of two fractions. No orange fraction corresponding to a beta-carotene isomer could be separated from the hypophase.

The epiphasic pigments were also subjected to paper chromatography. The pigments were taken up in ethyl alcohol: acetone (1:3), spotted and developed on paper treated with different concentrations of olive oil (0.5 to 4%) in benzene, using 2 different developing solvents, *viz.* petroleum ether: benzene (1:3) and petroleum ether: benzene: ethyl alcohol (15:6:1). The spots diffused outwards in the paper without any separation.

The behaviour of pigments from the latex of clone PB 186 was compared with that of pigments from other clones reported to give latices of different colour intensities. Chromatograms prepared of pigments from clones RRIC 5, RRIC 7, Tjir 1, Nab 12, Nab 16, LCB 1320, and RRIM 501 showed essentially the same pattern as those of clone PB 186, but the orange fraction that eluted out fast from the epiphasic pigments of clone LCB 1320 showed a different absorption spectrum, with a maximum at 427.5 mu. in petroleum ether (60–70°C).

Aurochrome, formed by the action of dilute HCl on carotene diepoxide has an absorbance maximum of 425mu. in petroleum ether (60–70°C) but its presence was not detected in the epiphasic pigments eluted from the latex of clone LCB 1320.

6.3. **Enzymes in latex.**—Experiments have been initiated for the determination in latex fractions and in scrap rubber of tyrosinase, a copper-containing enzyme.

REVIEW OF THE SMALLHOLDINGS DEPARTMENT

By

A. B. Dissanayake

SUMMARY

The Chief Advisory Officer Smallholdings was on duty throughout the year. The Senior Assistant Advisory Officer was on duty throughout the year except during his end-of-contract leave from 1st April to 30th June and the Assistant Advisory Officer (North) was on 3 months end-of-contract leave from 1st June to 31st August. Mr. K. W. de Silva, A.A.O. (N) and Mr. D. E. A. Abeywickrema, A.A.O. (S) acted for S.A.A.O. for 2 months and 1 month respectively. Mr. R. A. Somadasa, Chief Clerk, was appointed Office Assistant, Smallholdings Department. A Conference of the Supervisory Officers was held at Smallholdings headquarters.

Mr. W. P. H. Dias, J.P., the Smallholders' Representative on the Rubber Research Board, and the writer made a tour of inspection in the Northern Sector. Mr. R. Martin, a Visiting French Agronomist, was shown smallholdings work in the main rubber-growing districts.

The Department participated in the Bogambara Exhibition.

Loans for the purchase of vehicles were granted to 6 officers.

Two leaflets on Tapping and on Soil Conservation have been prepared for publication.

A pair of Hunter's "Pluto" rubber rollers was purchased for a smallholder at a concession rate. Two tons of a fertilizer mixture were bought through this Department by a co-operative society of smallholders at concession rates. Brass mesh for strainers and aluminium pans, too, were sold at concession rates to smallholders by way of assistance for better sheet making.

The Annual Field Day was held at Kesbewa. The Chairman, Rubber Research Board, the Director R.R.I.C., the Smallholders' Representative on the Rubber Research Board, a visiting French Agronomist and the Botanist, R.R.I.C. attended the Field Day.

31,621 visits were paid to replanted smallholdings during the year, inclusive of 23,816 visits in respect of previous years' permit areas. 1,851 Subsidy holdings for which replanting permits have been issued in 1961, totalling 2,561 acres 0 roods 34 perches, were lined by Rubber Instructors and Assistants for soil conservation works and 2,189 Subsidy holdings of 3,015 acres 3 roods 26 perches were lined for planting-holes.

In addition to the above, these officers lined 758 holdings of 1,128 acres 0 roods 00 perches in extent for soil conservation works and 802 holdings of 1,218 acres 3 roods 16 perches for planting holes, in the previous year's permit areas. Rubber Instructors marked a total of 29,002 trees of suitable girth for tapping in 509 Subsidy holdings.

Field officers of this Department carried out random checks on planting material issued by the Rubber Controller at the Commodity Purchase Depots to Subsidy replanters and a total of 24,854 plants were checked on 204 visits to various Depots.

3,067 preliminary reports on the suitability of holdings for new planting of rubber were submitted to the Rubber Controller. 5,161 visits were made by the field staff to new-planting permit areas of this year and of the previous year for advice and lining. Instructors and Assistants lined 437 new planting areas of 589 acres 3 roods 36 perches for soil conservation works and 663 acres 2 roods 10 perches in 482 holdings for planting-holes, in this year's permit areas. Similarly 218 permit areas of 311 acres 3 roods 35 perches in extent were lined by Rubber Instructors and Assistants for soil conservation work and 214 permit areas of 314 acres 1 rood 34 perches in extent for planting-holes in last year's new-planting permit areas. Rubber Instructors marked 7,029 tappable trees in 124 new-planted holdings.

Soil conservation grants totalling Rs. 3,314/43 were paid in respect of 76 peasant-class permit holders. The existing rates for payment of soil conservation work were found to be inadequate. New rates submitted to the Rubber Research Board were approved.

2,024 final inspection reports were sent to the Rubber Controller to enable him to register these lands as Rubber holdings.

The State-aided Sulphur Dusting Scheme sponsored by this Department successfully organized 86 co-operative sulphur dusting groups, during the year 1961. In all a total of 8,835 acres (2,592 holdings) were successfully dusted. Dusting operations commenced on 9-1-61 in the Pelmadulla dusting group in the Pelmadulla range. The dusting operations for the season were concluded on 1-4-61 when the last holdings of the Kotawella group were given their fifth round of dusting. It has been observed that whilst undusted holdings were infected severely by *Oidium*, the degree of attack being more than that observed last year, the dusted holdings generally escaped attack. In a very few cases where wintering was very late and where rain interfered with sulphur dusting a slight infection was noticed in the dusted holdings. Arrangements have been finalised for the dusting in January 1962 of approximately 9,599 acres of rubber in 2,929 holdings. A total of 95 sulphur dusting groups were accepted by the end of 1961.

The Publicity Unit has functioned successfully throughout the year. Its services were appreciated by smallholders, 23,000 of whom attended 151 slide shows-*cum*-exhibition meetings held in all ranges in 1961. A sum of Rs. 9,000/- has been approved by the Rubber Replanting Advisory Board for the purchase of a portable generator and a 16 mm. Cine Projector for the proposed second Publicity Unit.

Rubber Instructors conducted 744 sheet-making demonstrations. Instructors paid 924 and 1,801 visits to demonstration smokehouses and ordinary smokehouses respectively to advise on sheet improvement. 640 tapping, 518 disease-control and 498 miscellaneous demonstrations were given by the field staff.

A survey to find out the economics of a replanted smallholding was begun during this year. At the request of the Rubber Replanting Advisory Board a survey of tapping under-girth trees, replanted from 1953-1956 under the Subsidy Scheme, was started. The report on the survey will be submitted to the Rubber Replanting Advisory Board in January 1962.

DETAILED REVIEW

Introduction.—The work of the Smallholdings Department both in the field and in the office increased during the year under review. Fairly large numbers of Subsidy Replanting and New Planting permits were again issued. The consolidation of the old sulphur dusting groups and the organization of new groups and supervision of all the groups were again undertaken. The Publicity Unit functioned in the field throughout the year. Assistance in the form of advisory visits, lining for planting-holes and soil conservation works and the usual routine advisory services were given to rubber smallholders.

1. GENERAL.

1.1. Staff.—Mr. A. B. Dissanayake, the Chief Advisory Officer Smallholdings, was on duty throughout the year.

Mr. H. H. Peiris, Senior Assistant Advisory Officer, was on duty throughout the year except during his end-of-contract leave from 1st April to 30th June.

Mr. K. W. de Silva, Assistant Advisory Officer (North), acted for the S.A.A.O. in April and May, while Mr. D. E. A. Abeywickreme, Assistant Advisory Officer (South), acted for him in June.

Mr. K. W. de Silva, A.A.O. (N) was on 3 months' end-of-contract leave from 1st June to 31st August.

Mr. R. A. Somadasa, Chief Clerk, was appointed as Office Assistant of the Smallholdings Department with effect from 1st January 1961.

A conference of the Supervisory Officers was held at the Smallholdings headquarters on 24-4-61.

1.2. Visits.—Mr. W. P. H. Dias, J.P., the Smallholders' Representative on the Rubber Research Board, and the writer made an extensive tour of field inspection of smallholdings in the Northern Sector from 14th to 17th February 1961.

1.3. Exhibitions.—The Department participated in the Bogambara Exhibition, organized by the Co-operative Department, from 19th to 26th August.

1.4. Loans.—Loans amounting to Rs. 20,450.00 for the purchase of vehicles were granted to 6 officers during the year.

1.5. Correspondence.—The following figures in regard to correspondence are an indication of the volume of work performed both in the field and at headquarters:—

General:

Inward	7,963	
Outward	11,703	

With the Rubber Controller:

Inward	1,125	(from Rubber Controller with new planting Applications, etc.)
Outward	6,244	(including 3,067 Preliminary Reports, 2,024 Final Inspection Reports and 1,153 Special Reports, etc.)

From the field officers to permit holders—4,630 not included in the above figures.

1.6. Publications. Two leaflets on Tapping of Rubber and on Soil Conservation have been prepared for publication. As it was thought desirable to illustrate these leaflets with photographs taken on smallholdings, a delay in publication has been caused due to non-availability of the photographs.

1.7. Visitors. Mr. Martin, a visiting French Agronomist, was shown over smallholdings by the Chief Advisory Officer Smallholdings from 8th to 15th November. The areas visited included Galle, Ratnapura, Avissawella, Kegalla, Colombo and Matugama.

2. ASSISTANCE TO SMALLHOLDERS.

Lining for soil conservation works and for planting holes was carried out by the field staff who also advised smallholders on tapping procedure, disease control, manuring and sheet making.

A pair of Hunter's "Pluto" rubber rollers was purchased for a smallholder at the usual discount rate allowed to smallholders who purchase them through this Department.

Two tons of R 4:6:5 fertilizer mixture were bought through this Department at concession rates for a co-operative society of smallholders in Udagoda Government Colony.

335 square feet of mesh for strainers and 1,194 aluminium pans were sold at concession rates to smallholders during the year by way of assistance for better sheet making.

3. ANNUAL FIELD DAY.

The annual field day was held at the Kesbewa Maha Vidyalaya on 25th November 1961. The Chairman, Mr. T. C. A. de Soysa; the Smallholders' Representative on the Rubber Research Board Mr. W. P. H. Dias, J.P.; the Director, Dr. L. D. C. Baptiste; the Botanist, Mr. C. A. de Silva and Mr. Martin, a visiting Agronomist, attended.

The field work from 8–10 a.m. consisted of lectures and demonstrations on lining, cutting silt-pitted drains, construction of silt pits in leader drains, construction of stone terraces, spill platforms and splash cushions and gully control. For these the necessary structures were constructed before the field day in order to show the field staff the correct and incorrect methods.

The full programme for the day was as follows:—

8–00— 9–00 a.m.	...	Lining demonstration.
9.00—10.00 a.m.	...	Demonstrations for Soil Conservation.
10.00—10.15 a.m.	...	Tea Break.
10.15—11.00 a.m.	...	Welcome of Chairman, Director, etc.
		Short addresses by: 1. The Chairman, R.R.B.
		2. The Director, R.R.I.C.
		3. The Smallholders' Representative.

11.00—11.45 a.m.	...	Lecture on "The Tapping of *Hevea* Rubber" by the Botanist, R.R.I.C.
11.45—12.00 noon	...	Question Time.
12.00—12.30 p.m.	...	Lecture by the Chief Advisory Officer Smallholdings on "Extension Methods available for educating the Smallholder".
12.30 p.m.	...	Conclusion of Field Day Programme.

4. REPLANTING.

Considerable attention was paid by the field staff in assisting smallholders and small estate owners in replanting their holdings according to the requirements of the Rubber Replanting Subsidy Scheme. The following replanting permits issued in respect of the year 1961 were in force at the end of the year:—

	No. of Permits	*Acres*	*Roods*	*Perches*
Estates over 100 acres ...	398	10,044	2	16
Estates between 10–100 acres	803	6,068	1	17
Smallholdings under 10 acres	5,826	8,442	1	12
	7,027	24,555	1	05

Every one of the above 5,826 smallholdings was visited by a Rubber Instructor. 31,621 visits were paid during the year to smallholdings under the Scheme, inclusive of 23,816 visits in respect of previous years' permit areas.

During the year Rubber Instructors and Assistants lined 1,851 holdings totalling 2,561 acres 0 roods 34 perches for soil conservation works and 2,189 holdings totalling 3,015 acres 3 roods 26 perches for planting-holes, in this year's permit areas.

Similarly, these officers have lined a further 758 holdings of 1,128 acres 0 roods 00 perches in extent for soil conservation works and 802 holdings of 1,218 acres 3 roods 16 perches in extent for planting-holes, in permit areas of the previous year. 347 special reports on Subsidy Replanting areas were submitted to the Rubber Controller.

A total of 29,002 tappable trees have been marked for tapping by Rubber Instructors by way of demonstrations in 509 replanted holdings.

A total of 204 visits were made by the field staff for the purpose of random checking of the planting material issued at the various Commodity Purchase Depots to replanting smallholdings. 24,854 plants were checked at these visits. Whenever smallholders' sheets were examined by Rubber Instructors at these visits to Depots all defects seen were pointed out to the smallholders and full advice was given on ways of avoiding these defects in smoked sheet.

5. NEW PLANTING.

5.1. Advisory Visits.—Apart from replanting work Rubber Instructors devoted part of their time in visiting, advising and assisting Rubber new-planting smallholders. Each new land for which new-planting rights were applied for was visited and reported on by a Rubber Instructor before a permit was issued by the

Rubber Controller. 3,067 such preliminary inspections were made and reports sent to the Rubber Controller throughout the year. 2,142 new planting permits covering 2,862 acres 0 roods 00 perches were issued during the year. 5,161 visits were made by the field staff to new-planting permit areas of this year and previous year for advice and lining. A new record sheet (yellow form) was entered up for each of this year's new-planting areas visited. The condition in which the previous year's new-planted areas was found and the work recommended to be done were recorded in the relevant form of each such permit areas visited in 1961. 2,024 Final Inspection Reports and 1,153 Special Reports were made by Rubber Instructors during the year.

Rubber Instructors and Assistants lined 437 holdings of 589 acres 3 roods 36 perches in extent for soil conservation works and 482 holdings of 663 acres 2 roods 10 perches in extent for planting-holes in this year's permit areas.

Similarly, 218 holdings of 311 acres 3 roods 35 perches in extent were lined by Rubber Instructors and Assistants for soil conservation works and 214 holdings of 314 acres 1 rood 34 perches in extent were lined for planting-holes, in last year's new-planting permit areas. Divisional Advisory Officers have checked such lining in the field in 305 new-planting holdings.

Rubber Instructors marked 7,029 tappable trees in 124 new-planted holdings.

5.2. Payments for Soil Conservation Works.—Rs. 3,314.43 were paid as Soil Conservation grants to 76 peasant class permit holders. 105 holdings were measured by Instructors and vouchers were prepared and submitted. Of these, 96 measurement forms were checked by Divisional Advisory Officers in the field.

The following were the approved rates of payment for soil conservation measures adopted in new plantations:—

Type I—Gentle slope (*i.e.* 1 in 20 and under) ...	...	Rs.	30.00
Type II—Medium slope (*i.e.* between 1 in 20 & 1 in 4) ...	...	,,	50.00
Type III—Steep slope (*i.e.* steeper than 1 in 4) ...	...	,,	75.00

These rates which were approved in 1948 were found to be inadequate hence new rates were submitted to the Rubber Research Board for approval. The following are the new rates for payment of soil conservation works for smallholdings approved by the Rubber Research Board:—

Type I—Near flat	1 in 10 and under	...	Rs.	50.00
Type II—Gentle to Moderate slope	1 in 10 to 1 in 3	...	,,	80.00
Type III—Strong slope	1 in 3 to 1 in 2.5	...	,,	120.00
Type IV—Steep to very Steep slopes	1 in 2.5 and over	...	,,	240.00

6. SPECIAL INSPECTIONS FOR RUBBER CONTROL DEPARTMENT.

The following inspections were undertaken at the request of the Rubber Controller, in addition to the normal advisory visits:—

Visits for Preliminary Reports ...	...	...	3,067
Visits for Final Inspection Reports	...	...	2,024
Visits for Special Reports ...	...	...	1,153
Visits for Checking Planting Material	...	...	204

7. WHITE ROOT DISEASE.

The *Fomes* survey in smallholdings replanted between 1953 and 1955 was concluded during 1959.

No follow-up survey was carried out during 1961.

8. SULPHUR DUSTING.

The organization of the State-aided Co-operative Sulphur Dusting Scheme for the purpose of controlling *Oidium* leaf disease on smallholdings was successfully completed for the year 1961. Under this Scheme the Smallholdings Department provides sulphur dusting machines to the smallholders free of charge and the necessary technical advice and guidance in organizing the sulphur dusting groups and in carrying out the dusting operation, while sulphur dust of approved quality is supplied at a subsidized rate of half the price to *bona fide* smallholders (owning under 10 acres).

The advice and the necessary propaganda for the formation of co-operative groups commenced at the end of July of the previous year.

As a result of the wide publicity given to the State-aided Sulphur Dusting Scheme it was possible to exceed the target fixed for the year 1961.

Necessary instructions regarding correct procedure of dusting were given to all staff prior to commencement of dusting. These instructions covered the proper maintenance of dusting machines, supervision of dusting, provision of daily, weekly and monthly reports on the progress and results of dusting and the checking of accounts of incidental expenses of different co-operative dusting groups. All the forms necessary for these purposes were distributed among the staff well in time.

Each accepted co-operative dusting group was issued a sulphur dusting machine on loan. Spare machines were made available at central spots to avoid interruption of dusting due to machine breakdown. The departmental mechanic was also available for repairs in the field during dusting. Major repairs, however, were carried out by the agents of the machines.

Applications were received from 89 tentatively formed groups. Three groups, however, could not be included in the scheme due to insufficient acreage in the groups, failure in making payment for sulphur in time and general lack of co-operation among the smallholders. Thus only 86 dusting groups comprising 2,592 holdings giving a total acreage of 8,835 were accepted for dusting.

As in previous years, Kalutara continued to be the single district with the largest acreage dusted, *i.e.* 2,347$\frac{1}{2}$ acres as against 2,091$\frac{3}{4}$ acres in the previous year.

This year the smallest acreage dusted in a single district was Matara with 564$\frac{1}{2}$ acres, as the Kandy district which had one co-operative dusting group functioning last year failed to participate in the Scheme this year due to lack of a sufficient number of smallholders to form an economic co-operative dusting group. (Table I).

TABLE I.

District	No. of Groups 1961	No. of Holdings 1961	Acreage 1961
Kalutara ...	22	629	2,347½
Colombo ...	17	603	1,831¾
Kegalla ...	23	748	2,015¼
Ratnapura ...	12	389	1,278½
Galle ...	7	128	797⅛
Matara ...	5	95	564½
Kandy ...	—	—	—
Total ...	86	2,592	8,835

This year some of the older co-operative sulphur dusting groups were made to function on their own with no help from the Department. In these groups collection of money, transport and distribution of sulphur dust, dusting and all other work in connexion with dusting were done by the group members themselves under the guidance of their energetic Group Organizers.

Dusting operations commenced on 9-1-61 in the Pelmadulla sulphur dusting group in the Pelmadulla range. The first dusting group to complete dusting was the one organized at Udagoda (Undugoda Range), where the final round was completed on 11-2-61. The dusting operations for the season were concluded on 1-4-61 when the last holdings of the Kotawella Group (Kegalla Division) were given their fifth round of dusting.

It has been observed that whilst undusted holdings were infected severely by *Oidium*, the degree of attack being higher than that observed last year, the dusted holdings generally escaped attack. In a very few cases, where wintering was very late or where rain interfered with sulphur dusting, a slight amount of infection was noticed in the dusted holdings.

Summary.

Number of holdings dusted	2,592
Acreage dusted	8,835
Number of groups which functioned	86
Number of machines used	117
Acreage dusted per machine	75½ acres approx.
Average size of a holding	3 2/5 acres
Size of the smallest holding	¼ acre
Size of the largest holding	31 acres
Average number of holdings in a group ...	30

Average cost of dusting an acre, including sulphur Rs. 12.39.

The smallest holding to be dusted was ¼ of an acre in extent. The total acreage dusted consisted of 6,643¼ acres of budded rubber, 1,340¾ acres of clonal seedling rubber and 851 acres of ordinary unselected seedling rubber.

Acreage classified according to type of rubber.

Of the total acreage, 6,718 acres or 76% were provided with subsidized sulphur at a rate of Rs. 6.05 per acre and 2,117 acres were supplied with sulphur dust at the non-subsidized rate of Rs. 12.10 per acre. The total average cost of dusting an acre was Rs. 12.39, including the cost of sulphur.

8.1. Sulphur Dusting during 1962.—Arrangements have been finalised for the dusting in January to March 1962 of approximately 9,599 acres of rubber in 2,929 holdings. A total of 95 sulphur dusting groups were accepted by the end of 1961. The distribution according to revenue districts would be as follows:—

District	*No. of groups.*
Kalutara	22
Colombo	23
Kegalla	23
Ratnapura	14
Galle	7
Matara	5
Kandy	1
Total ...	95

The sulphur dust of the required quality was purchased and distributed among all smallholders taking part in the scheme. Sulphur dust at the subsidized rate was issued for dusting 2,768 holdings each below 10 acres in extent. Detailed instructions have been given in all aspects of dusting, including maintenance and care of machines. The sulphur dusting demonstrations for training machine operators of new groups will begin in January 1962.

9. PUBLICITY UNIT.

The Publicity Unit has functioned successfully throughout the year. Its services were greatly appreciated by smallholders, 23,000 of whom attended 151 slide shows-*cum*-exhibition meetings held in all ranges during 1961.

Exhibitions are held shortly after 4.00 p.m. when local exhibits collected by the range Instructor and other posters and exhibits are displayed at the School, Temple or Rural Society Hall. Shortly after the exhibition a meeting of local rubber smallholders is held with the range Rubber Instructor presiding. The range Instructor, Rubber Instructor Publicity Unit, and the Divisional Advisory Officer Smallholdings when present, deliver simple lectures in Sinhala on various important aspects of rubber planting such as disease control, soil conservation, manuring, tapping, sheet making, etc. The colour slide show commences at about 8 p.m and each set of slides is explained by a running taped commentary on the subject visually put across to the audience on the screen. The slides shown at present are on Soil Conservation, *Fomes* disease, *Oidium* disease, Tapping and on Posters advising against tapping under-girth rubber trees. Further sets of colour slides on different subjects are expected to be prepared in 1962.

A sum of Rs. 9,000/- has been approved by the Rubber Replanting Advisory Board for the purchase of a portable generator and a 16 mm. Cine Projector for the proposed second Publicity Unit. Quotations have been called for these and for a Tripod Screen, Microphone and two Dual Reflex Horns. Suitable films on rubber and allied agricultural subjects will be loaned out from Government Departments and Embassies for projection by this Unit, until such time as a separate film on rubber production is prepared.

10. DEMONSTRATIONS.

Rubber Instructors conducted 744 sheet-making demonstrations. Instructors paid 924 and 1,801 visits to demonstration smokehouses and ordinary smokehouses respectively to advise on sheet improvement.

In addition to the sheet-making demonstrations mentioned above, 640 tapping, 518 disease-control and 498 miscellaneous demonstrations were given by the field staff.

For the purpose of improving the smoking of smallholders' sheet, Rubber Instructors persuaded them to commence building 59 demonstration smokehouses and 71 ordinary smokehouses. Forty-six of the demonstration smokehouses and 39 of the ordinary smokehouses were satisfactorily completed during the year.

11. SURVEYS.

11.1. Rainfall Survey.—Rubber Instructors were asked to send daily rainfall returns beginning from 1st April 1961 and a separate form was sent to each Rubber Instructor for this purpose. All Instructors started sending these returns indicating rainfall figures gathered from Estates, Agricultural Research Stations and Farms and Meteorological Stations, etc., in their ranges.

11.2. Survey of the Economics of a Rubber Smallholdings.—A survey to find out the cost of replanting a smallholding was begun during this period. Three forms were sent out to all Rubber Instructors with a circular letter explaining how the survey was to be carried out. The forms sent out were:—

1. To work out the cost of replanting a Smallholding.
2. „ „ „ „ „ „ maintenance in the first year.
3. „ „ „ „ „ „ maintenance in the second year.

The records are being maintained by reliable smallholders under the guidance and supervision of the Rubber Instructor of the range. It is expected that this survey will be completed by mid 1962.

11.3. Tapping Survey.—At the request of the Rubber Replanting Advisory Board a survey of tapping under-girth trees replanted from 1953 to 1956 under the Rubber Replanting Subsidy Scheme was started. For this purpose 4 villages were selected at random from each of the 47 ranges. In each of these villages thus selected for inspection of all smallholdings planted under the Subsidy Scheme from 1953 to 1956, both years inclusive, the inspectors were made to note the following:—

1. Holdings where tapping has commenced at the correct stage (Girth of 20″ at 3 ft. over 60% of the plantation).
2. Holdings where tapping has commenced when about 40 to 50% of trees in the plantation had attained a girth of 20″, but with a few under-girth trees also brought into tapping.
3. Holdings where tapping has commenced when the majority of trees are under-girth.
4. Holdings not maintained properly (very weedy lands).
5. Holdings with tapping cuts opened at the wrong heights and angles, etc.

The report will be submitted to the Rubber Replanting Advisory Board in January 1962.

REVIEW OF THE ESTATE DEPARTMENT

By

L. Wijeyegunawardene

SUMMARY

The Institute's stations at Dartonfield, Nivitigalakele and Hedigalla in extent 1,491 acres 0 roods and 30 perches, bear a planted acreage of 1,009 of which 685 acres were tapped during the year. At Hedigalla 57 acres were under nursery for the Rubber Replanting Subsidy Scheme.

Weather conditions were less favourable for tapping and harvesting of crop than during the previous year. The South-West monsoon rains were normal, causing fair wind damage in the outlying divisions. An unprecedented rainfall of over 100″ was recorded during the third and fourth quarters of the year.

A very satisfactory crop was however obtained, amounting to 417,537 lb and representing an average yield of 604.7 lb per acre.

The immature rubber acreage was 303 acres, 2 roods, 33 perches during the year, of which thirty-one acres formed part of a replanted area at Dartonfield.

The incidence of *Oidium heveae* during refoliation of early winterers was light, but the late winterers were adversely affected. Satisfactory control was achieved by sulphur dusting.

Phytophthora leaf fall was less pronounced than last year and presented no difficulty of control of the disease with the use of copper-based fungicide. The incidence of *Gloeosporium* appeared to be more marked than in the previous year, particularly at Hedigalla, and caused some concern. With the judicious use of organo-mercurial fungicides, the occurrence of Bark Rot was considerably reduced in spite of the heavy rainfall during the third and fourth quarters of the year.

Under 'Exchange of clones', budwood of twelve RRIC clones and five other local clones and of six foreign clones was despatched to U.S.D.A. Plant Introduction Station, Florida, and Firestone Plantations Company, Liberia, in June 1961. Budwood of six clones was received from Liberia in August 1961 and multiplied in nurseries at Nivitigalakele.

Budwood of RRIC clones continued to be much in demand and issues to estates and smallholdings were attended to. Routine weeding, cultivation and other agricultural operations were carried out in all mature and immature areas of the Group.

The Rubber Replanting Subsidy Scheme nursery at Hedigalla continued to be supervised throughout 1961. The nursery was in full production.

Estimates for 1962 connected with the working of the Group, field and factory experiments, etc., were prepared by the writer and approved by the Rubber Research Board.

In connection with the Hedigalla Nursery an Estimate for 1962 was prepared and submitted to the Rubber Replanting Advisory Board.

DETAILED REVIEW

1. GENERAL.

1.1. Staff.—The Superintendent, Mr. L. Wijeyegunawardene, was on duty during the year. The Assistant Superintendent, Mr. D. de S. de Fonseka, resigned on 7th December 1961.

The Works Section was separated from the Estate Department, resulting in a decrease of the Estate Department cadre by 15 members, made up as follows:—

Intermediate Staff	...	...	1
Assistant Staff	...	...	2
Minor Staff	...	...	12

Mr. E. T. Seneviratne, Clerk-Typist, was released for work in the Works Section.

The Apothecary, Mr. B. R. E. Mendis, resigned on 5th May, and he was succeeded by Mr. J. W. S. Bulner, on 21 July.

Mr. H. A. Sirisena, Factory Attendant, was promoted to Assistant Rubber Maker with effect from 1 January.

Mr. D. L. W. Lionel was appointed Sinhalese School Master at Hedigalla on 1st February in place of Mr. D. S. Wickremasinghe who retired on reaching the age-limit.

Mr. A. Fernando was appointed Dispenser at Hedigalla on 1st February. This is a new appointment.

Two Field Attendants attached to the Chemistry Department were made Factory Attendants (Experimental), and were taken off the Estate Department cadre.

The Estate Department cadre stood at 44 at the close of the year, made up as follows:—

Senior Staff	...	...	1
Intermediate Staff		...	1
Assistant Staff	...	...	22
Minor Staff	...	...	20

1.2. Visiting Agent.—Mr. W. B. Jonklaas paid two visits to the Institute's properties during the year. Reports on these visits were submitted to the Rubber Research Board.

1.3. Correspondence.

Inward ...	...	...	500
Outward	...	...	1,260

1.4. Weather (Estate Gauge).—Comparative rainfall figures (inches) for 1960 and 1961 are given below:—

Month	Dartonfield		Nivitigalakele		Hedigalla	
	1961	1960	1961	1960	1961	1960
January	11.61	4.94	5.38	6.15	9.39	9.64
February	1.74	14.39	1.08	15.20	6.65	20.27
March	10.95	7.96	10.30	5.24	16.26	7.46
April	11.74	12.29	14.28	15.20	14.41	17.95
May	23.51	9.57	23.07	13.58	20.33	15.88
June	9.99	7.26	10.18	7.56	9.80	7.76
July	13.13	20.55	13.88	21.75	13.34	12.97
August	16.49	2.75	14.29	5.68	19.27	7.63
September	24.57	8.95	23.66	10.71	19.70	13.53
October	18.21	13.21	16.22	12.22	20.74	13.39
November	21.66	10.25	16.76	16.03	16.07	12.72
December	12.37	5.28	11.15	7.59	13.86	6.54
	175.52	117.40	160.25	136.91	179.82	145.74
Average (5 year period)	148.21″		152.30″		185.84″	
Total No. of Wet Days	255	212	239	185	267	248

The rainfall for the year at Dartonfield, Nivitigalakele and Hedigalla Divisions amounted to 175.5″, 160.3″ and 179.8″ respectively and was above the five-year average by 27.3″ and 8.0″ at Dartonfield and Nivitigalakele and fell short of the average by 6.0″ at Hedigalla. February was an exceptionally dry month. The third and fourth quarters of the year recorded an unprecedented fall of over 100″ fairly evenly distributed. There were approximately forty more wet days this year than last year.

1.5. Acreage Summary—Dartonfield Group.

Rubber	Dartonfield			Nivitigalakele			Hedigalla			Total		
	A.	R.	P.	A.	R.	P.	A.	R.	P.	A.	R.	P.
Mature ...	90	1	39	136	3	01	458	0	12	685	1	12
Immature ...	40	3	20	9	3	18	252	3	35	303	2	33
Nurseries ...	5	2	00	14	1	07	—	—	—	19	3	07
Total ...	136	3	19	160	3	26	711	0	07	1,008	3	12
Abandoned due to wind damage, etc. ...	—	—	—	2	0	04	—	—	—	2	0	04
Building sites ...	34	2	36	7	3	29	8	1	18	51	0	03
Pinewood plantation	—	—	—	—	—	—	1	0	34	1	0	34
Roads ...	6	2	22	0	3	27	9	0	04	16	2	13
Swamp area ...	—	—	—	0	2	08	0	2	20	1	0	28
Streams and reservations	0	0	29	—	—	—	13	0	29	13	1	18
Jungles, etc. ...	—	—	—	1	3	38	395	0	00	396	3	38
Grand Total ...	178	1	26	174	1	12	1,138	1	32	1,491	0	30

The total cultivated acreage of the Group stood at 1,008 acres, 3 roods and 12 perches by the end of the year.

1.6. Crop.—Weather conditions were less favourable for tapping and harvesting of crop than last year due to more wet days and higher rainfall. In spite of the conditions that prevailed, a very satisfactory crop of 417,537 lb was achieved as against the estimate of 352,000 lb.

	1961	1960
Estimated ...	352,000 lb	325,000 lb
Harvested ...	417,537 „	376,139 „
Excess ...	65,537 lb	Excess 51,139 lb

Actual crop harvested for 1960	376,139 lb
Test tapping biscuits from other sources ...	1,400 „
Actual crop manufactured	377,539 lb

Comparative Yield Records of Individual Fields

Dartonfield	Acreage in tapping	Total Yield in lb 1961	Total Yield in lb 1960	Yield in lb per acre 1961	Yield in lb per acre 1960
1934, 1936 & 1939 Replanted Areas ...	—	—	15,490	—	815.3
1938 Replanted Area ...	4½	4,721	17,720	1,049.1	1,107.5
1941 „ „ ...	5	3,275	4,343	655.0	668.1
1947 „ „ ...	8	4,876	6,283	609.5	761.6
1950/51 „ „ ...	25¾	17,858	17,893	693.5	694.9
1952 „ „ ...	28	17,743	19,999	633.7	661.1
1953 „ „ ...	11½	3,542	2,524	308.0	219.5
1954 „ „ ...	7¾	664	—	85.7	—
	90½	52,679	84,252	582.1	718.6

Nivitigalakele	Acreage in tapping	Total Yield in lb 1961	Total Yield in lb 1960	Yield in lb per acre 1961	Yield in lb per acre 1960
1926 Replanted Area ...	10½	14,005	7,514	1,338.8	715.6
1927 „ „ ...	9¾	13,060	6,010	1,339.5	616.4
1928 „ „ ...	10½	12,501	6,844	1,190.6	651.8
1935 „ „ ...	28½	25,561	23,645	896.9	829.6
1939 „ „ ...	10¼	7,672	8,927	748.5	870.9
1940 „ „ ...	9¾	7,276	8,446	746.3	866.3
1940 Swamp Area ...	3¼	3,669	4,251	1,128.9	1,308.0
1941 Clearing	7	6,709	7,622	958.4	1,088.9
1942 „	4½	5,037	5,628	1,119.3	1,250.7
1943 „	7	5,321	5,833	760.1	833.3
1944 „	4½	4,777	5,567	1,061.6	1,237.1
1946 Replanted Area ...	21	25,405	28,600	1,209.8	1,361.9
1954 Clearing	10	8,531	5,636	853.1	563.6
	136½	139,524	124,523	1,022.2	912.3

Hedigalla	Acreage in tapping	Total Yield in lb 1961	Total Yield in lb 1960	Yield in lb per acre 1961	Yield in lb per acre 1960
1943 Clearing	10¼	10,045	10,603	980.0	1,034.4
1944 ,, ...	11¾	9,752	11,047	829.9	940.2
1945 ,, ...	22¼	23,512	21,602	1,056.7	970.9
1946 ,, ...	12¾	12,680	13,179	994.5	1,033.7
1947 ,, ...	45	33,057	30,881	734.6	686.2
1949 ,, ...	34¾	25,059	25,403	721.1	731.1
1950/51 ,, ...	20	11,403	9,259	570.2	462.9
1952 ,, ...	74¾	33,536	27,525	448.6	404.8
1953 ,, ...	136½	49,838	17,865	365.1	137.9
1954 ,, ...	90	13,130	—	145.9	—
	458	222,012	167,364	484.7	472.4
Total for the Group ...	685	414,215	376,139	604.7	618.6
Slaughter tapping at Dartonfield	—	3,322	—		
T.T. biscuits from outside estates	—	—	1,400		
	685	417,537	377,539		

1.7. Tapping.—(*a*) Tapping was resumed after a fortnight's rest during refoliation on the 27th and 28th February and 6th March at Dartonfield, Nivitigalakele and Hedigalla respectively. The uneven wintering of trees was most noticeable due to the numerous clones planted in close proximity to one another.

During the wintering period, tapping panels were marked with the appropriate bark consumption in keeping with the systems of tapping adopted in the various experimental clearings.

(*b*) Yields of fields are, in general, of the expected order except in fields which are under various tapping systems for experimental purposes.

1.7.1. Analysis of tapping rounds on Dartonfield Group for 1961 (1960 figures in brackets)

					No tapping					
Dartonfield:	Early tapping		Late tapping		Winter rest		Rain		Holidays	
1st Quarter ...	53	(60)	13	(10)	16	(16)	2	(—)	6	(5)
2nd ,, ...	39	(32)	24	(34)	—	(—)	24	(20)	4	(5)
3rd ,, ...	32	(49)	30	(17)	—	(—)	30	(26)	—	(—)
4th ,, ...	40	(56)	35	(21)	—	(—)	14	(13)	3	(2)
	164	(197)	102	(82)	16	(16)	70	(59)	13	(12)

Nivitigalakele:	Early tapping		Late tapping		No tapping: Winter rest		Rain		Holidays	
1st Quarter ...	63	(69)	6	(5)	16	(15)	2	(2)	3	(—)
2nd ,, ...	39	(47)	29	(20)	—	(—)	17	(17)	6	(7)
3rd ,, ...	39	(58)	27	(15)	—	(—)	26	(19)	—	(—)
4th ,, ...	61	(66)	19	(15)	—	(—)	12	(11)	—	(—)
	202	(240)	81	(55)	16	(15)	57	(49)	9	(7)

Hedigalla:	Early tapping		Late tapping		No tapping: Winter rest		Rain		Holidays	
1st Quarter ...	52	(48)	12	(15)	23	(15)	2	(12)	1	(1)
2nd ,, ...	40	(31)	14	(14)	—	(—)	30	(39)	7	(7)
3rd ,, ...	24	(42)	23	(16)	—	(—)	45	(34)	—	(—)
4th ,, ...	38	(53)	27	(23)	—	(—)	27	(16)	—	(—)
	154	(174)	76	(68)	23	(15)	104	(101)	8	(8)

1.8. Manufacture.—A summary of the various forms of manufacture during the year is given below:

Latex Grades	Total in lb	Percentage
Smoked sheet No. 1 ...	6,528	1.56
,, ,, ,, 3 ...	616	0.15
Pale crepe No. 1 ...	207,140	49.61
,, ,, ,, 2 ...	61,559	14.75
,, ,, ,, 3 ...	76,895	18.42
Latex for Experiments	349	0.08
	353,127	84.57

Scrap Grades	Total in lb	Percentage
Scrap Crepe No. 1 ...	46,592	11.16
,, ,, ,, 2 ...	13,952	3.34
,, ,, ,, 3 ...	3,248	0.78
Scrap for Experiments	618	0.15
	64,410	15.43
Grand Total ...	417,537	100.00

Increasing difficulties are envisaged in the manufacture of uniform No. 1 crepe as the Hedigalla crop increases. This is mainly due to the variation in latices obtained from the numerous clones under experimentation.

1.9. Miscellaneous.

Field and Factory Experiments.—The Chemistry, Botany, Plant Pathology and Soils Departments were given assistance in carrying out their field and factory experiments.

Estimates.—Estimates of Capital and Revenue Expenditure for 1962 in respect of Dartonfield Group, prepared and submitted by the writer to the Rubber Research Board, were approved.

Estate Roads.—All motorable roads and paths were maintained in good condition throughout the year.

Manuring.—Mature areas of the Group received their quota of fertilizers in keeping with the R.R.I. programme.

2. PESTS AND DISEASES.

2.1. Oidium heveae.—The incidence of *Oidium heveae* was negligible during the latter part of January and the first fortnight of February. A spell of dull weather with low temperatures from mid February gave a fillip to the activity of the fungus and late winterers experienced a fairly heavy leaf fall. Regular sulphur dusting operations were carried out throughout the Group. The presence of numerous clones on a per acre basis planted in close proximity to each other, resulting in an uneven wintering, necessitated, in the initial and later stages, a protracted spell of 'spot' dusting. A very satisfactory control was, however, achieved.

2.2. Phytophthora palmivora.—As in the previous year, a mild leaf fall was observed in early July and a few rounds of spot dusting was carried out on clones in areas susceptible to the disease. The short dry spell in the second and third weeks of July was indeed helpful in inhibiting the possible activity of the fungus and prevention of leaf fall. In late August, however, a change in the weather conditions seemed conducive to the development and spread of *Phytophthora* particularly at Hedigalla Division and further dusting was resorted to. The use of copper-based fungicides together with the dusting technique employed proved adequate and effectively sealed off any spread of the fungus and its attendant leaf fall.

2.3. Bark Rot.—With the judicious use of the organo-mercurial fungicides, Antimucin and Kankerdood, the incidence of Bark rot was considerably reduced in spite of the heavy rainfall which occurred during the third and fourth quarters of the year.

2.4. Root Diseases.—A few scattered cases of *Fomes lignosus* and *Ustulina zonata* were found on the mature areas and routine measures of control were adopted. Details of loss of trees due to various causes were given in the monthly reports of this Department.

2.5. Wind Damage.—The loss of trees due to wind damage on Dartonfield, Nivitigalakele and Hedigalla were 39, 108 and 399 trees respectively.

3. CAPITAL ACCOUNT—AGRICULTURAL DEVELOPMENT.

Dartonfield Division—Immature Replanted Areas.

1953	Replanted Area (Planted in 1956)				...	5 acres
1955/56	,,	,,	...	...	...	$4\frac{3}{4}$,,
1960/61	,,	,,	...	...	...	$31\frac{1}{2}$,,
						$41\frac{1}{4}$,,

Nivitigalakele Division—Immature Areas.

1953 Clearing	... ...	10 acres

Hedigalla Division—Immature Areas.

1952 Clearing	... ...	$4\frac{3}{4}$ acres
1953 „	... ...	$5\frac{1}{2}$ „
1954 „	... ...	$87\frac{1}{2}$ „
1955 „	... ...	78 „
1956 „	... ...	60 „
1957 „	... ...	$17\frac{1}{4}$ „
		253 acres

Routine weeding, cultivation and other agricultural operations were carried out. The Immature areas are in good condition and were maintained up to the required standards of sound agricultural practice.

3.1. Number of Trees Uprooted—Immature Areas.

Dartonfield ... Nil
Nivitigalakele ... Nil

Hedigalla:	1953	1954	1955	1956	1957
Wind damage ...	41	2	20	—	—
Fomes lignosus	—	—	1	2	9
Fomes noxius	—	—	24	15	1
Thinning out	4	293	39	—	—
	45	295	84	17	10

3.2. 1961 Replanting (30 acres) at Dartonfield.—This area consists of four separate blocks of $7\frac{1}{2}$ acres, $9\frac{1}{2}$ acres, 13 acres and 2 acres, previously replanted in 1934, 1936, 1938 and 1939 respectively. Approximately 2 acres were left unplanted due to D.G.E.U. mains running through the clearing. In accordance with the requirements of the Botanist two tapping tasks of each of the following clones were planted during the South-West and North-East monson seasons; RRIC 88, RRIC 89, PB 28/59, PB 86, RRIC 7, RRIC 52 and RRIM 513. The replanted area was well weeded, manured, and the plants are coming on well.

3.3. 1962 Replanting (15 acres) at Nivitigalakele.—Fifteen acres of the 1926 and 1927 areas earmarked for replanting were lined and holed at 12′ × 20′ and the uprooting of trees, cutting and stacking of timber were in progress to be in readiness for a burn in February-March 1962.

4. NURSERIES.

4.1. Dartonfield Seedling and Budwood Nurseries.

(*a*) Routine weeding and clearing of drains were carried out in all the nurseries. Plants were manured in accordance with the Institute's recommendations.

(*b*) Overgrown plants bearing over-matured budwood were lopped systematically.

4.2. Nivitigalakele—Seedling and Budwood Nurseries.

(*a*) Weeding, clearing of drains and manuring were done.

(*b*) Vigorous growing stocks in these nurseries were budded to meet the following requirements:—

1,100	budded	stumps	to Kuruwita Sub-station.
605	,,	,,	for multiplication nursery at Nivitigalakele.
2,526	,,	,,	to Dartonfield (Replanting).
260	,,	,,	to Commercial Estates.

(*c*) Overgrown plants bearing overmatured budwood were lopped for obtaining fresh budwood.

(*d*) 1,237 yards of budwood of various clones were despatched to estates and smallholdings, 923 yards to Karapincha Farm for Kuruwita Sub-station, 41 yards to Moneragala Breeding Station, 4 yards to the Rubber Research Institute of India, 17 yards to U.S.D.A. Plant Introduction Station, Florida, and 6 yards to Firestone Plantations Company, Liberia.

5. LABOUR AND HEALTH.

(*a*) The regular labour force was inadequate and temporary casual labour was employed to meet requirements.

(*b*) Line room accommodation was satisfactory. Repairs to all cottages were carried out according to the programme.

(*c*) Wages were paid during the year in accordance with the Wages Board Ordinance in force.

Dartonfield Group.

		Resident	Non-resident	Total
Working Ceylonese				
Men	...	117	170	287
Women	...	88	103	191
Children	...	1	—	1
Working Immigrants				
Men	...	40	—	40
Women	...	27	—	27
Children	...	—	—	—
		273	273	546

Annual Holidays.—Annual holidays with pay were given to all labourers who were entitled to these in accordance with the Ordinance.

Maternity Benefits.—Eighteen full maternity benefits and two medical wants benefits payments were made.

Feeding Children and Milk Foods.—Free rations and ¼ lb bread were issued to each non-working child. Milk foods were issued to all infants whose mothers were incapable of nursing them.

Health.—The health of the members of the Institute's staff and of the estate labourers was satisfactory during the year.

Anti-Mosquito Measures.—DDT/Gammexane spraying was carried out throughout the year, at regular intervals, in and around the bungalows and lines under the supervision of the Apothecary and the Dispenser.

Births.—Eight children were born during the year on the Group.

A list of diseases treated by the Institute's Apothecary and the Dispenser is given below:

Influenza	1,204
Ulcers	267
Ankylostomiasis	165
Diarrhoea and Enteritis	149
Ear diseases	59
Other diseases	2,733
Total ...	4,577

6. RUBBER REPLANTING SUBSIDY SCHEME NURSERY AT HEDIGALLA

6.1. Supervision.—The Estate Superintendent, R.R.I.C., paid supervisory visits to this nursery during the year.

6.2. Staff.—Mr. L. Samaranayake, Assistant Nursery Manager.

6.3. Rainfall.—179.82 inches were recorded as against 145.74 inches in the previous year.

6.4. Seedling Nursery.

(*a*) The nursery acreage of 57 remained unchanged. In accordance with the decision of the Rubber Replanting Advisory Board, one-third of the total nursery acreage was allowed to be fallow for one year on a three year rotation scheme. The area not planted with rubber seedlings was sown with *Crotolaria anagyroides*.

(*b*) Nineteen acres of nursery beds were prepared during the second quarter of the year to receive Tjir 1 seed from the July/August seed fall. This area was fully planted by the end of September.

6.5. Budwood Nursery.—3,100 planting points made up of buddings of PB 86, LCB 1320 and RRIC 52 supplied the entire quantity of budwood from this nursery for the North-East and South-West issues of planting material for the Rubber Control Department.

6.6. Maintenance.—The seedling and budwood nurseries were satisfactorily maintained throughout the year. Routine weeding, manuring and attention to paths and drains were carried out.

6.7. Pests and Diseases.—The incidence of *Oidium* was very light and a few rounds of sulphur dusting was carried out in February and March.

(*b*) A mild attack of *Phytophthora* and *Gloeosporium* occurred during the wet months of September, October and November necessitating several rounds of spraying with Perenox.

6.8. Weedicides.—Some interesting weed killing trials were laid out by the Soils Chemist and observations are being made.

6.9. Planting Material.—44,099 budded stumps of clone PB 86 and 58,208 Tjir 1 clonal seedlings were issued from this nursery by the Rubber Control Department during the South-West and North-East planting seasons.

6.10. General.—Mr. E. O. B. Lover was appointed Visiting Agent to this nursery as from September 1961.

REVIEW OF THE R.R.I.C. SUB-STATION, KURUWITA

By

B. Cocking

Introduction.—This is the first review of the Rubber Research Institute's Sub-station which was established in May 1960 at Kuruwita. Progress since its inception has been very satisfactory and it fulfils, with its experimental areas under Plant Breeding Section of the Botany Department and under the Soils Department of the Institute, many of the functions for which it was intended.

1. GENERAL

1.1. Staff.—During the year the estate has been adequately supervised by the Senior Field Assistant, Mr. L. P. de Mel, assisted by a General K.P. and three supervisory Kanganies. Whenever additional supervision has been required personnel have been loaned from Rambukkanda Group.

The Visiting Agent, Mr. W. B. Jonklaas, visited the estate on 4 September 1961 and submitted a report to the Director. The recommendations embodied in that report have now been largely implemented.

1.2. Acreage

		A.	R.	P.
Mature Polyclonal Rubber	...	48	3	32
Old Seedling Rubber	...	40	0	33
Replanted in 1961	...	83	3	20
For Replanting in 1962	...	38	3	00
Nurseries	...	2	1	24
Roads, Deniyas, Forests and Gardens	...	16	0	25
Total	...	230	1	14

Recent surveys for replanting, the opening of nurseries, and the erection of buildings have necessitated amendments to the acreage of some fields. The above statement is correct as on the 31 December 1961.

1.3. Rainfall in inches

		1960	1961
January	...	6.77	6.86
February	...	11.46	7.73
March	...	9.21	10.76
April	...	13.92	21.34
May	...	15.43	27.48
June	...	18.32	14.19
July	...	16.51	15.06
August	...	7.81	21.05
September	...	17.23	20.59
October	...	9.96	16.52
November	...	12.68	11.18
December	...	2.40	6.58
Total	...	141.70	179.34

Rainfall during the year was considerably heavier than that experienced in 1960. April, May, August, September and October all proved to be exceptionally wet months.

1.4. Crop

		1960	1961
Estimated	...	—	72,000 lb
Harvested	...	98,075	51,639 lb

Since the Institute only came into active possession of the estate quite late in 1960 it was not possible to frame crop estimates for that year. The crop estimate for 1961 was based upon a yield expectation of 500 lb per acre of rubber in tapping. Unfavourable weather conditions and a late introduction of intensive tapping in the area to be uprooted for replanting in 1962 have combined to produce a fairly substantial shortfall in the estimate for the season.

1.5. Manufacture.—From September 1960 until the end of October 1961 all rubber was transported to Rambukkanda Group factory for manufacture into crepe. This arrangement was expensive in transport costs and inconvenient to Rambukkanda Group factory.

From 1 November 1961, following the purchase of hand-rollers, smoked sheet manufacture was initiated in the Sub-station factory and smokehouse and early results have received encouraging remarks from the Brokers. The General K.P., Mr. Weerasooriya, now fulfils the functions of rubber-maker in addition to his other responsibilities.

2. BUILDINGS

During 1961 the construction of the following was completed:—

One Staff Bungalow (Grade I)
One General Factory and Office building
One 5,000 lb capacity Smokehouse
Six double-unit Labourers' Cottages

It is hoped to complete the installation of power, light and water supply to these buildings early in 1962. The construction of two Junior Staff quarters and the conversion of two old sets of lines into manure and sulphur store rooms will complete the building programme on this estate.

3. LABOUR

Most of the present labour force is composed of Gonapitiya villagers employed on a casual basis for clearing work. These workers, together with a majority of the tappers taken over from Paradise Estate, have worked extremely well during the year. However, a vocal minority of the ex-Paradise tappers steadfastly refuse to move into the new cottages recently constructed for them, and earlier in the year, during my absence on furlough, organised a brief, partial, protest strike against the allocation of tapping blocks.

4. CLEARINGS

1961 Replanting, 83A. 3R. 20P.—This clearing has been fully planted during the year, largely with new experimental clones. The entire area is now under a monthly weeding round and all areas previously under grass have recently been poisoned with sodium arsenite. The young plants are growing well throughout the clearing. Two instalments under the Rubber Replanting Subsidy Scheme have now been received.

1962 Replanting, 38A. 3R. 00P.—Felling and clearing operations in this area were completed by the end of December 1961, including the complete extraction of all tap roots as recommended by the Visiting Agent. Draining, fencing and the burning of all roots continue to receive attention. It should be possible to plant this clearing during the period April/May 1962.

5. NURSERIES

Of the two nurseries, one planted in 1960 will supply the Sub-station with most of its requirements for the 1962 clearing whilst the other, planted in 1961, will provide the material for the less ambitious replanting programme envisaged for future years. Plants in excess of requirements will be sold under the commercial nursery permit.

Printed for the RUBBER RESEARCH INSTITUTE OF CEYLON, *Dartonfield, Agalawatta,*
by H. W. CAVE & CO., LTD., *Fort, Colombo.*

RUBBER RESEARCH INSTITUTE OF CEYLON

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All enquiries and other communications should be addressed to the Director, Rubber Research Institute of Ceylon, Dartonfield, Agalawatta.